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A Comparative Study of Nurses' Knowledge Regarding Preventive Measures and Precautions for Viral Hepatitis B and C at Hemodialysis Units among Southern Provinces of Iraq

Dissertation Submitted to

The Council of College of Nursing, University of Babylon in partial fulfillment of the requirements for the Degree of Doctorate of Philosophy in Nursing Sciences

By

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بِسْمِ اللّهِ الرَّحْمَنِ الرَّحِيمِ

(وَأَنفِقُواْ فِي سَبِيلِ اللّهِ وَلاَ تُلْقُواْ بِأَيْدِيكُمْ إِلَى التَّهْلُكَةِ وَأَحْسِنُوَاْ إِنَّ اللّهَ يُحِبُّ الْمُحْسِنِينَ)

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Supervisor Certification

This is to certify that the dissertation, which entitled (**A Comparative Study of Nurses' Knowledge Regarding Preventive Measures and Precautions for Viral Hepatitis B and C at Hemodialysis Units among Southern Provinces of Iraq),** submitted by **Abdulkareem Salman Khudhair** to the University of Babylon, College of Nursing in partial fulfillment of the requirements for the degree of Doctorate of philosophy in Nursing Sciences. The dissertation work was carried out by the student under my supervision.

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Committee Certification

We, the members of the Dissertation Discussion committee, certify that we have reviewed the dissertation entitled **(A Comparative Study of Nurses' Knowledge Regarding Preventive Measures and Precautions for Viral Hepatitis B and C at Hemodialysis Units among Southern Provinces of Iraq)** which is submitted by **Abdulkareem Salman Khudhair**, from the Adult health Nursing Department, and we have examined the student in its contents, and what is related to it in / / 2021.

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Dedication

To

The souls of my parents

I never forget, with All Love and Respect.

To

My wife, and my sons and daughters'

To

My sisters and brothers with love and respect

Acknowledgement

First of all, great thanks for God, the Glorious most merciful the most compassionate, and the prayer and peace of God be upon our Master and Prophet Muhammad and his divine good family, who guided us to get out of the darkness of nescience.

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Abstract

A descriptive cross-section study was carried out at hemodialysis units in four provinces in southern Iraq (Basra, Maysan, Dhi Qar, and Muthanna) from January 2019 to June 2021.

The study aims to assess nurses' knowledge regarding viral hepatitis B and C preventive measures and precautions at hemodialysis units, and to compare nurses' knowledge among the four provinces.

A purposive sample from 96 nurses was selected from four hemodialysis units. The data was collected through the use of a questionnaire constructed for this purpose. It comprised five domains with (42) items and an interview face to face technique used as a means of data collection.

The validity of the instrument was determined by a panel of experts, and by using the coefficient test of Cronbach’s Alpha, the reliability of the study tool was determined. Application of descriptive statistics (frequency, and percentage), and inferential statistics (mean of the score, Chi-square, one-way-ANOVA test, and Post-Hoc multiple comparison (Scheffe test) are used to analyze data.

The results of the study indicated that hemodialysis nurses in four provinces have moderate knowledge regarding hepatitis B and C preventive measures and precautions, and there are significant differences among nurses' knowledge at hemodialysis units in four southern provinces in Iraq.

The study concluded that the highest percentage of patients infected with viral hepatitis B and C in a hemodialysis unit in Basrah province, and a lower percentage of infected patients in a hemodialysis unit in Muthanna province. And also the study concluded that nurses' knowledge differs significantly at hemodialysis units in four southern provinces in Iraq.

The study recommended nurses who have the highest educational levels should be assigned to work in hemodialysis units and special instructions should be posted on the walls of the hemodialysis unit, where all nurses may see them, highlighting basic preventative measures and precautions for hepatitis B and C. and also the study recommended that an instruction manual on preventive measures and precautions against hepatitis B and C should be published and delivered to patients with renal failure on

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Abbreviation	Meaning
APIC	Association for professionals in infection control
BBV	Blood borne virus
CDC	Centre for disease control and prevention
CKD	Chronic kidney disease
DNA	Deoxyribonucleic acid
ESKD	End stage kidney disease
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCW	Health care worker
HD	Hemodialysis
HIV	Human immunodeficiency virus
NAT	Nucleic acid test
P	Page
P.P	Pages
P.value	Probability Value
PCR	Polymerase chain reaction
PD	Peritoneal dialysis
PPE	Personal protective equipment
RBC	Red blood cell
RNA	Ribonucleic acid
RRT	renal replacement therapy
SPSS	Statistical Package for the Social Sciences
WBC	White blood cell
WHO	World health organization

List of Abbreviations

Chapter One

Introduction

Chapter One

Introduction

1.1 Introduction:

Hemodialysis (HD) is the most frequent mode of renal therapeutic alternative therapy for end-stage kidney dysfunction patients. Patients undergoing (HD) are likely to have a risk of increased exposure to infection, especially blood-borne viruses (BBVs). Viral hepatitis such as hepatitis B (HBV) virus and hepatitis C (HCV) virus is the most frequent disease resulting in HD treatment (Ghafouraifard *et al.*, 2021; Bikbov *et al.*, 2020).

Infections with hepatitis B virus and hepatitis C virus are known and important causes of liver disease in end stage kidney disease (ESKD) patients and HD patients. The length of HD therapy is also a risk factor for viral hepatitis transmission (Hamidi *et al.*, 2020; Wang *et al.*, 2018).

Some hemodialysis patients are infected with viral hepatitis such as hepatitis B and C, which are present in their blood. If blood is contaminated by the blood of another patient who has a viral infection, these infections may be transmitted to other patients (Patrice *et al.*, 2013; (Gasim *et al.*, 2012; Mina *et al.*, 2010; Toosi *et al*., 2008).

Hepatitis caused by a virus causes inflammation in the liver. This may be caused by a variety of things, including viruses, bacteria, drugs, or toxic materials. Viral hepatitis is known to be caused primarily by viruses. Hepatitis A, B, C, D, and E are the viruses that cause hepatic inflammation. Because of the high prevalence of hepatitis around the world, liver disease (hepatitis) has become a major public health issue (Bosan *et al*., 2010).

Hepatitis has a comprehensive definition that includes inflammation, damage, and dysfunction caused by several causes associated with infection,

or other factors such as viral, toxic, pharmacological factors in the liver, or immune causes (Topbaş *et al.,* 2017).

Infectious hepatitis and serum hepatitis are two distinct types of viral hepatitis. Hepatitis A and E are transmitted through a fecal-oral route. Both of these viruses cause abdominal pain, loss of appetite, vomiting, fever, and jaundice when consumed in contaminated water. Both of these symptoms are self-limiting, and the virus is cleared by the immune system. Because it requires a superficial hepatitis B antigen for transmission, hepatitis D is an incomplete ribonucleic acid (RNA) virus that can't cause infection without the assistance of hepatitis B. As a result, this infection can only cause harm to people who have hepatitis B (Beckingham and Krige, 2001).

Hepatitis B is a viral infection that affects the liver and causes acute and chronic liver disease. Viral hepatitis B is one of the major blood-borne infections and a threat to hospital staff. The presence of this disease leads to a high prevalence of infection in the general population. Medical professionals and paramedical personnel may get infected and transmit the disease. Because of the frequent contact of nurses with blood and blood products, they are at a high risk of infection. The nursing staff should be familiar with the treatment and epidemiological aspects of diseases such as transmission, prevention, and control (Khanum *et al*., 2018).

Hepatitis B virus and HCV infections are serious public health problems that can have consequences in terms of psychological and occupational diseases. They are common causes of occupational diseases, which can be transmitted from patients to healthcare professionals and from the professionals to their patients. Furthermore, it may spread to members of their family due to intimate contact. Fortunately, infection transmission at the occupational level can be prevented by following standard precautions (Setia *et al.*, 2013).

An estimated 257 million people worldwide are infected with the chronic hepatitis B virus, and 71 million people are infected with the chronic hepatitis C virus. The prevalence of viral hepatitis, particularly the prevalence of hepatitis B caused by the hepatitis B virus (HBV) and hepatitis C, is higher in patients on hemodialysis (HD) than in the general population. The prevalence of hepatitis B and hepatitis C viruses varies greatly from country to country and within the country by HD unit (Lanini *et al.*, 2019)

Historically, the hepatitis B virus is concentrated in the Asia-Pacific, Africa, and the Amazon basin. The hepatitis C virus is found worldwide; its prevalence is higher in the above-mentioned areas than in the hepatitis B virus, but the hepatitis C virus is also an important health problem in Western Europe and North America (Thrift *et al.*, 2017; Lingala and Ghany, 2016; Alavian *et al.*, 2008; Prati, 2006).

Patients on hemodialysis have a greater frequency of hepatitis B and C than the overall population. Transmissions associated with hemodialysis have dropped considerably as a result of the application of preventative measures like vaccinations, serologic screening, and post-exposure treatment. Viral hepatitis spreading in hemodialysis was initially observed in the 1960s and has continued to this day (; Cai *et al.*, 2019; Sypsa *et al.*, 2005; Shamshirsaz *et al.*, 2004).

Hepatitis B virus and hepatitis C virus infections are important causes of morbidity and mortality among dialysis patients (HD) and create problems in the management of patients in dialysis units because patients with chronic renal failure do not clear this viral infection at all. About 200 million people are infected with the hepatitis C virus worldwide, where the incidence of the virus is reported to be between 3 and 4% in Asian countries, while in Central Africa and Egypt, it is 10-20% (Koop, 2008; Abdel-Hamid *et al.*, 2007).

Among healthcare professionals, HBV and HCV are transmitted through contaminated acupuncture, syringes, needles, or by accidental insemination of small amounts of blood during surgery. It is critical that they take the necessary precautions to avoid infection. However, HBV can be prevented through strict adherence to standard microbiological practices and techniques, and routine use of appropriate precautions to prevent exposure to the skin and mucous membranes when dealing with blood and other body fluids for all patients in health care settings, and pre-vaccine exposure (Winston *et al*., 2020).

Even after numerous publications on transmission prevention programs and strategies, hepatitis B and C infection remains a major public health issue for humanity. It has been recommended that prevention is a guarantee against the epidemic of viral hepatitis. A safe and effective vaccine for hepatitis B has been available for the past three decades, although it is not possible for hepatitis C virus infection. By knowing the facts, having proper awareness and attitudes, the risk of this disease can be largely prevented (Askarian *et al.*, 2011).

The risk factors for HBV and HCV in dialysis patients include blood transfusions, total time spent on dialysis, intravenous drug use, and a history of kidney transplantation. The dialysis-related risk is around 2%, varying according to the country. In addition, healthcare-related HCV transmission can be eradicated with control measures planned to avoid transmission of blood-borne pathogens (Gordon *et al.*, 2008).

The prevalence of HCV infections among HD patients is high and varies from (2% to 60%) between different countries, and between different dialysis centers within a single country (Toosi *et al.*, 2008).

1.2. Importance of the study

Hemodialysis necessitates meticulous patient treatment, and a professional nurse plays a key role in this, planning and executing procedures to manage and prevent injuries, as well as providing care that contributes to control, complication prevention, and health guidance. As a result, the nursing specialist's ability to perform professional judgment of nursing diagnosis and care plan for both signs and symptoms of the patient (Pinheiro *et al*., 2017).

The nursing staff is often emotionally supportive of dialysis patients, attempting to ascertain what the patient expects from the care given and the underlying reasons for modifying the treatment in order to increase the patient's quality of life by examining the significance that a person applies to his or her life experiences (Belzárez *et al*., 2021).

In the dialysis unit, the nurse plays an important role in monitoring, supporting, evaluating, and educating the patient. During dialysis, the patient and dialyzer both require constant monitoring because many complications are possible, including clotting of dialysis tubes or dialyzer, air blockage, insufficient or excessive fluid removal, low blood pressure, cramping, vomiting, blood leakage, contamination, and complications of access tubes (Drawz and Rahman, 2009).

Hemodialysis is a specialized nursing area focusing on patients with renal failure and their families' needs across the lifespan. This specialized care requires the nurse to promote competent, safe, ethical care, and demonstrate current specialty knowledge and practice. Patient education is a fundamental and essential component of nursing practice that improves the health of individuals and provides the necessary knowledge and skills for managing chronic illnesses such as kidney disease. The ultimate goal of patient education is to achieve long-lasting changes in behavior by providing

knowledge, practices, and abilities that allow patients to make autonomous choices and take possession of their own care to enhance their own outcomes (Marsha, 2008;Thomas and Zazworsky, 2005).

Good collaboration between nurses and other health professionals has the potential to improve the quality of nursing care. The hemodialysis service unit partly relies on senior nurses to teach and educate new staff members about techniques, and protocols while in the hemodialysis room. It is advisable that appropriate and structured education methods are needed to increase the knowledge of new hemodialysis nurses. Working as a nurse has a high level of work stress, which is caused by high demands from the social environment and his or her own profession (Al-Mawsheki *et al.*, 2016).

Hemodialysis is a lifesaving treatment that can offer significant advantages for certain patients, but it can also have serious risks if the patients and their caregivers do not track and understand the concept of its safety. Safety is the condition of being protected against physical, social, spiritual, financial, political, occupational, psychological, educational, or other types or consequences of failure, damage, error, accidents, harm, or any other event which could be considered non-desirable (Dawood *et al.*, 2016).

Keeping patients safe in the dialysis environment is a topic of great concern for patients and nurses. Nurses are at the center of patients' care. Furthermore, they are essential drivers of quality improvement. From the Institute of Medicine’s reports, patient safety remains one of the most critical issues facing health care today and nurses are the health care professionals most likely to intercept errors and prevent harm to patients (Kliger and Diamond, 2001).

Precautions and protection from needle sticks and acute injuries are important in preventing infection for nurses. Education on blood-borne

transmission, vaccination, and post-exposure prevention must be implemented. Further investigations are warranted to clarify the risk of this potentially serious infection to nurses (Reis *et al.*, 2005).

Various procedures are implemented for diagnosis and treatment in environments that provide health care services that carry the risk of infection. In these environments, the goal is to eliminate or restrict the source of infection and create a safe environment to provide protection against infection. Nurses are at risk of infection from infections acquired in the hospital. It was reported that among these infections, hepatitis B was observed at a rate of 30% and hepatitis C at 3% (Hinkle *et al*., 2018).

Healthcare workers are in constant contact with the affected patient's blood and body fluids. Exposure to blood and body fluids is defined as a direct injury through the patient's blood, contaminated needles, sharp objects, open wound contact, or mucus contact with these fluids (Senturk *et al.*, 2002).

The most effective approach to solving health problems is to provide adequate health protection measures. In the prevention of infectious diseases, knowing the modes of transmission and planning the necessary precautions accordingly is vital. Therefore, people who provide health services must have an adequate level of knowledge regarding infectious diseases that are often experienced in society, such as hepatitis (Göktalay and Özyurt, 2010).

The dialysis unit nurse plays a critical role in patient monitoring, support, assessment, and education. Multiple problems, such as circuit clotting, air embolism, inadequate or excessive ultrafiltration, hypotension, cramps, vomiting, blood leakage, contamination, and access difficulties, necessitate regular monitoring of the patient, the dialyzer, and the dialysate bath during dialysis. Therefore, the patient's nursing care and the vascular

access device's maintenance are absolutely essential (Drawz and Rahman, 2009).

Nurses play a key role in the prevention of HBV infection. Together with society, they are responsible for initiating and supporting activities that enhance a population's health and social needs (Hassan & Amin, 2017).

In addition, hemodialysis necessitates advanced nursing care, which includes establishing a therapeutic and interpersonal relationship, treating physical symptoms, and attending to functional disabilities and educational needs. In general, nurses are the primary caregivers for these patients, and their primary duty is to recognize the patients' critical needs. As a result, nurses' knowledge of high-quality care will influence patient care and satisfaction. In particular, the quality of nursing care offered is a significant predictor of nurses' participation in the care program ((Garthwaite *et al.*, 2019).

Globally, about 257 million and 71 million people are chronically infected with HBV and HCV, respectively, and are at risk of cirrhosis and liver cancer. These injuries were the cause of 1.34 million deaths in 2015 (WHO, 2017).

The importance of this study lies in determining the cognitive level of nurses working in dialysis units in these four provinces related to preventive measures and raising awareness of this trend to prevent the spread of hepatitis B and C among patients and nursing staff, which affect this. Positive improvements in health and career development, health promotion, and educational institutions, as well as the lack of guidelines for registered professional nurses for the prevention of hepatitis B and C, were among the reasons for this study.

1.3. Hypothesis

There is no relationship between nurses' knowledge and preventive measures and precautions for viral hepatitis B and viral hepatitis C at hemodialysis units in the southern provinces of Iraq.

There is a relationship between time between shift and viral hepatitis B and C infection**.**

1.4. Statement of the study

(A comparative study among nurses' knowledge regarding preventive measures and precautions for viral hepatitis B and C at hemodialysis units in the southern provinces of Iraq).

Hepatitis B and C infections are the leading causes of morbidity and death among hemodialysis patients, and they pose challenges in patient management in renal dialysis units as a result of chronic kidney failure patients' inability to clear these infectious agents effectively (Mina *et al*., 2010).

Nurses are at greater risk of needle stick injuries and developing viral infections, including hepatitis B and C, in hemodialysis units. It is estimated that there is about a 6%-30% risk of hepatitis B after a needle injury to a non-immune person, and 5-10% for hepatitis C (Askarian and Malekmakan, 2006).

1.5. Objectives of this study are to:

1. Assess nurses' knowledge regarding hepatitis B and C prevention measures and precautions.
2. Identify the percentage of HBV and HCV in four hemodialysis centers in the four provinces.

3. Find out the relationship between nurses' knowledge and their demographic data (age, gender, education level, training session, and years of experience).
4. Compare nurses' knowledge of hepatitis B and C regarding preventive measures and precautions among hemodialysis units in the four provinces.

1.6. Definitions of terms:

1.6.1. Nurse

1.6.1. a. Theoretical definition:

A professional person who has specialized knowledge and skills to promote wellness and to provide care for people in both health and illness in a variety of practice settings (Al-Hchaim and Hamza, 2016).

1.6.1. b. Operational Definition

A qualified person who can carry out patient care, management and needs to improve their abilities regarding preventive measures for hepatitis B and C at hemodialysis unit.

1.6.3. Knowledge

1.6.3. a. Theoretical Definition

Information, understanding or skills are acquired through experience or education. The fact or circumstances of knowledge familiarly achieved within practice (Lehrer, 2018).

1.6.3. b. Operational Definition

The information related to preventive measures regarding the reduction of the risk of viral hepatitis (B and C) infection in hemodialysis units.

1.6.3. Preventive measure

1.6.3. a. Theoretical Definition

Activities designed to protect patients or other members of the public from actual or potential health threats and their harmful consequences (Elliott *et al*., 2017).

1.6.3. b. Operational Definition:

Avoidance of viral hepatitis (B and C) infection by the nursing staff through the application of preventive measures and precautionary procedures in hemodialysis units.

1.6.4. Viral hepatitis

1.6.4. a. Theoretical Definition:

Viral hepatitis is a systemic, viral infection in which necrosis and inflammation of liver cells produce a characteristic cluster of clinical, biochemical, and cellular changes (Hinkle and Cheever, 2018).

1.6.4. b. Operational Definition:

It is an inflammation caused viral hepatitis B, viral hepatitis C, or both in people suffering from acute or chronic renal failure while receiving hemodialysis treatment.

Chapter Two

Literature Review

Chapter two
Literature Review

This chapter presents a review of all the available literature, which will cover all the aspects of preventive measures and precautions for hepatitis B and C diseases at hemodialysis units by using all available and up-to-date resources and references. It is very important to give a general information overview of all the topics of the study.

2. 1. Dialysis

Hemodialysis and peritoneal dialysis are two types of dialysis. Acute or urgent dialysis is indicated when there is an increasingly high level of potassium in the blood, excess fluid, or imminent pulmonary edema, increased acidity, and advanced uremia. It can also be used to remove medications or toxins from the blood or to treat edema that does not respond to other treatments, hepatic coma, hyperglycemia, hypercalcemia, high blood pressure, and high blood urea (Garthwaite *et al.*, 2019).

Chronic or maintenance dialysis is indicated in advanced chronic kidney disease (CKD) and ESKD in the following instances: the presence of uremic signs and symptoms affecting all body systems (nausea and vomiting, severe anorexia, increasing lethargy, mental confusion), hyperkalemia, and fluid overload not responsive to diuretics and fluid restriction, and a general lack of well-being. An urgent indication for dialysis in patients with kidney disease is pericardial friction rub, which is indicative of uremic pericarditis (Grossman and Porth, 2014).

Dialysis facilitates BBV transmission due to the great potential for blood exposure. BBV can survive and remain potentially contagious on the surfaces of clinical equipment through bloodstains that may not be visible to the naked eye. Some people receiving dialysis treatment have viral infections

such as hepatitis B and hepatitis C in their blood. This infection can be transmitted to other patients if the blood is contaminated with another blood with a viral infection (Froio *et al.*, 2003).

2.1.1. Peritoneal dialysis (PD)

Peritoneal dialysis is a procedure that uses the lining of the patient's peritoneal cavity as a semipermeable membrane for the exchange of fluid and solutes (Wright and Wilson, 2015).

The objectives of PD are to remove toxic substances and metabolic wastes, recreate normal fluids, and electrolyte balance. PD may be the preferred treatment for patients with kidney disease who are unable or unwilling to undergo hemodialysis or kidney transplants. Patients who are prone to rapid fluid, electrolyte, and metabolic changes that occur during hemodialysis experience fewer of these problems with a slower rate of PD. Therefore, patients with diabetes or cardiovascular disease, many older patients, and those who may be at risk for the negative effects of systemic heparin are the most likely candidates for PD. In addition, pulmonary edema, severe hypertension, and heart failure not responsive to usual treatment regimens have been successfully treated with PD. Less than 8% of patients with end-stage kidney disease receive PD as a treatment method (System, 2013).

2.1.2. Hemodialysis (HD)

Hemodialysis treatment is the process of using a dialysis machine and its various accessories where there is a negative spread of dissolved particles and water through the blood to the dialysate fluid compartment through the semipermeable membrane in the dialyzer. More than 1.8 million patients worldwide are on hemodialysis (Calisanie and Gunadi, 2021; Tannor, 2017).

Hemodialysis is an artificial way of maintaining hemostasis in the body in patients with severe renal impairment. It is indicated for those with acute renal failure and stage IV chronic renal failure. Most patients who are undergoing dialysis do so for a long period of time and are exposed to numerous side effects (Alkhan, 2015).

Hemodialysis (HD) sustains life for more than a million people worldwide, without which most of the patients would die within a few weeks. The life-sustaining treatment depends on an extracorporeal blood device and requires caregivers to in-depth process detailed aspects of the dialysis procedure in addition to an understanding of the pathophysiology of the uremic state (Ye *et al.,* 2020).

Hemodialysis is used for patients who are acutely ill and need short-term dialysis for days to weeks until kidney function resumes, and for patients with advanced chronic kidney and end-stage kidney failure who require long-term or permanent renal replacement therapy. Hemodialysis prevents death but does not cure renal disorders or stop the loss of endocrine or metabolic activities in the kidneys. More than 90% of patients who need long-term kidney replacement therapy are on chronic hemodialysis (Siregar *et al.,* 2020). Most patients receive intermittent hemodialysis that involves treatments four times per week with a median treatment duration of three to five hours in an outpatient setting. Hemodialysis may also be performed at the patient's home. With home dialysis, treatment time and frequency may be adjusted to satisfy optimal patient requirements (System, 2013).

The aims of hemodialysis are to extract toxic substances from the blood and to remove fluid overload. A dialyzer is an artificial kidney, with a synthetic semipermeable membrane through which blood is filtered to excrete uremic toxins and a desired amount of fluid. In hemodialysis, the blood, carrying toxins and nitrogenous wastes, is converted from the patient

to an artificial kidney through the use of a blood pump to the dialyzer, where toxins are excreted from the blood and the blood is returned to the patient (Weiner *et al.*, 2014).

The hemodialysis principles are diffusion, osmosis, and ultrafiltration. By diffusion, the toxins and wastes in the blood are excreted. That is, they move from an area of high concentration in the blood to an area of low concentration in the dialysate. The solution that circulates through the dialyzer is called dialysate, which contains all the electrolytes in their ideal extracellular concentrations (Grossman and Porth, 2014).

The level of electrolytes in the patient's blood can be controlled by properly adjusting the electrolytes in the dialysate solution. The semi-permeable membrane inhibits the spread of large molecules, such as RBCs and proteins. Excess fluid is removed from the blood through osmosis, where water travels from an area with a low concentration (blood) to a high concentration area (dialysate bath). In ultrafiltration, the liquid moves under high pressure to a lower pressure area. This process is much more efficient than osmosis at removing fluids and is accomplished by negative pressure or suction strength of the dialysis membrane. Because patients with a disease requiring dialysis usually can't secrete water, this force is necessary to remove fluids to achieve fluid balance. The main treatment for chronic kidney disease failure involves an invasive dialysis procedure. Therefore, patients undergoing dialysis treatment are at risk of viral infection due to insufficient cellular immunity. Although dialysis has increased the durability of patients, some patients may have experienced some viral infections (Hinkle and Cheever, 2018).

The major risk to patient and staff safety is healthcare-associated infections. Hemodialysis patients, as well as dialysis staff, are susceptible to healthcare-associated infections because of frequent and prolonged exposure

to several possible contaminants within the hemodialysis environment. The increased risk is especially due to:

1. The immune-compromised status of dialysis patients.

2. Prolonged and frequent exposure to blood during HD treatments through vascular access and extracorporeal circuit.

3. Close contact with other patients during treatment within the hemodialysis facility.

4. Prolonged contact with healthcare workers, who move between patients and between machines.

5. Frequent hospitalization and surgery, and, most importantly, most significant.

6. Non-adherence or breaks in the implementation of recommended practices.

Patients with end-stage renal disease are at risk of infectious diseases because of their impaired immunity and high risk of exposure to pathogens. Dialysis patients are susceptible to blood-borne infections transmitted through needles, transfusions, and dialysis catheters. Therefore, it's very important to determine infection control measures to stop the transmission of pathogens in hemodialysis facilities (Park *et al.*, 2018; Hinkle and Cheever, 2018).

Hemodialysis patients (HD) may be more likely to develop blood-borne viral agents (HBV, HCV) compared to the general population, making them a constant public health concern because they are a cause of increased morbidity and mortality. The prevalence of hepatitis B virus in dialysis facilities in Western Europe, the United States of America, and Japan was found to be between 0 to 6.6 %. In contrast, in the Asia-Pacific region, they

ranged from 1.3 to 14.6%. The prevalence of HCV in HD varies considerably from a low of 1 to 70% overall, less than 5% in high-income countries (Roushan *et al*., 2016).

2.2. Overview of viral hepatitis.

In the late 1960s and shortly after the introduction of dialysis for the treatment of chronic kidney disease, outbreaks of viral hepatitis were reported among patients and staff in dialysis units in different parts of the world. Although most infected individuals did not develop a serious disease, specific deaths from hepatitis B virus infection acquired in conjunction with kidney treatment were documented, and a large proportion of those infected were chronically infected. It was then quickly established that hepatitis B infection could be transmitted through blood transfusions and that infected patients could transmit the virus within the dialysis unit to other patients and health care workers (Lok, 2003; Yanai, 2001)**.**

An outbreak of hepatitis in dialysis units sparked considerable public concern and led to the appointment of Lord Rosenheim in the UK in 1970 and the commissioning of an independent commission of inquiry. The report, released in 1972, known as the Rosenheim Report, released 12 documents showing the outbreak of hepatitis in dialysis units across the country, from 1965 to 1971, affected more than 300 individuals, one third of whom were healthcare professionals, with a mortality rate of 5% (Kao and Chen, 2018).

A short time later, other blood-borne and hepatitis-factors were identified. Moreover, as the number of dialysis patients' increases and the number and volume of dialysis centers increases, infections that appear to escape infection control practices sometimes continue to occur. With frequent handling of vascular access, direct and indirect transmission of infectious agents through equipment, environmental surfaces, or staff hands

or gloves that are likely to become contaminated with infectious blood or other bodily fluids all contribute to increased susceptibility to infection (Chaan *et al*., 2008).

Viral hepatitis is a systemic, viral infection in which necrosis and inflammation of liver cells produce a characteristic cluster of clinical, biochemical, and cellular changes. To date, five definitive types of viral hepatitis have been identified: hepatitis A, B, C, D, and E. Hepatitis A and E are similar in mode of transmission (fecal–oral route), whereas hepatitis B, C, and D share many other characteristics. Hepatitis is easily transmitted and causes high morbidity and prolonged loss of time from school or employment. Acute viral hepatitis affects 0.5% to 1% of people in the United States each year. Hepatitis A is responsible for 37% of all cases, and hepatitis B is the offending agent in 18% of cases. The occurrence rate has been decreasing steadily since 1990, largely because of the use of hepatitis A and B vaccines as well as public health education regarding high-risk behaviors. It is estimated that 60% to 90% of viral hepatitis cases go unreported. The occurrence of subclinical cases, failure to recognize mild cases, and misdiagnosis are thought to contribute to the underreporting (Goldman and Ausiello, 2008).

Viral hepatitis is a disease that causes liver inflammation. This may be caused by many factors, including viruses, bacteria, drugs, or any toxic substances. Viruses are known to be the leading cause of hepatitis, and for this reason, they call hepatitis viral hepatitis (Doumas *et al*., 2010).

Viral hepatitis in some people has no symptoms, while others have jaundice (yellow discoloration of the skin and whites of the eyes), poor appetite, vomiting, tiredness, abdominal pain, and diarrhea. However, hepatitis is acute if it is treated within six months, and chronic if it lasts more than six months. Acute hepatitis can develop into chronic hepatitis, or

(rarely) result in acute liver failure. Chronic hepatitis may develop into liver cirrhosis, liver failure, and liver cancer (Mohammed and Hassan, 2014).

Viral hepatitis has been classified into two types: infectious hepatitis and serum hepatitis. Hepatitis A and E have a fecal-oral route for transmission. Both of these viruses are spread by drinking contaminated water and cause abdominal pain, loss of appetite, vomiting, fever, and jaundice. These are both self-limiting and the virus is scanned by the body's immune system. Hepatitis D is an incomplete RNA virus and can't cause infection without the help of hepatitis B because it requires a superficial hepatitis B antigen to transport. Therefore, this infection can only cause positive hepatitis B patients (Beckingham and Krige, 2001).

Hepatitis B virus infection and the hepatitis C virus are major public health issues globally. Patients with HBV/HCV co-infection have a higher risk of progression to cirrhosis and unhealthy liver disease and an increased risk of liver cancer. Because liver viruses share the same modes of transmission, co-infection is common, especially in areas where the prevalence of hepatitis C virus infection is high and among people at risk of developing hepatitis (Malhotra *et al.*, 2016).

Hepatitis B and hepatitis C virus infections are important causes of morbidity and mortality among dialysis patients (HD) and create problems in the management of patients in dialysis units because patients with chronic renal failure do not clear this viral infection at all. About 200 million people are infected with the hepatitis C virus worldwide (Abdel-Hamid *et al.*, 2007).

In addition, hepatitis B and C are the world's leading killer diseases. The majority of people do not know that they suffer from hepatitis B and C as symptoms appear after nearly a decade of infection and this is how diseases spread to other people. The virus silently damages the liver and, as

symptoms appear, it becomes too late to treat the disease (Zainab *et al*., 2016).

In dialysis units, HBV deoxyribonucleic acid (DNA) and HCV ribonoclytic acid (RNA) have been detected in the dialysate of many patients who were under dialysis. Nevertheless, there is no evidence that internal fluid pathways provide a viable route for BBV transmission (Lindley *et al.*, 2011).

Hepatitis C infection in dialysis patients varies by region, ranging from 1 to 84.6 %. Infection with HBV/HCV is uncommon in severely infested areas and among individuals at high risk of parenteral transmission due to common transmission practices. Patients with dual HBV/HCV infection are at a higher risk of developing cirrhosis and developing hepatocellular carcinoma (HCC). In dialysis patients, long-term exposure to blood vessels and multiple blood transfusions increase the risk of these blood-borne illnesses. Contaminated devices, equipment, and supplies, as well as contaminated surfaces and personnel, may all play a role in the spread of this infection. Hepatitis virus infections are exacerbated in dialysis patients by a major immune dysfunction that develops as a result of an irreversible renal settlement. HBV infection is less common than HCV infection in dialysis units as a result of the introduction of the HBV vaccine, isolation of HBV-positive patients, use of dedicated dialysis machines, and frequent monitoring of HBV infection(Amran *et al.*, 2019; Karoney and Siika, 2013; Bhaumik and Debnath, 2012; Aghakhani *et al.*, 2012; Sagnelli *et al.*, 2009; Shi *et al.*, 2005)

However, (HBV) and (HCV) are common and serious causes of chronic liver disease and liver damage. More than 500 million people live with chronic viral hepatitis worldwide, according to the World Health Organization. Since 50% to 80% of hepatitis C virus infections lead to

chronic hepatitis, the growing burden of the hepatitis C virus is significant. In addition, an estimated 57% of cirrhosis and 78% of liver cancer due to hepatitis B virus infection or hepatitis C virus are considered. The Middle East and Iran are in a medium-sized state of endemicity with a carrier ratio of between 2% and 8% (Anders *et al.,* 2013; Fuller *et al.,* 2011; Stubbs *et al*., 2010).

Hepatitis B virus infection is less prevalent than HCV in hemodialysis (HD) units. Hepatitis B virus infection is less prevalent than the hepatitis C virus in hemodialysis units. The prevalence of hepatitis B virus infection in HD units in developing countries ranges from 2% to 20%, and the prevalence of hepatitis C virus among HD patients ranges from 4% to 70% in different countries (Hamissi and Hamissi, 2011; Telaku *et al*., 2009; Reddy *et al.*, 2005).

Viral hepatitis outbreaks, defined as two or more new seroconversions, continue to occur in hemodialysis units. Almost one-third of the 33 nosocomial hepatitis B virus outbreaks from 1992 to 2007 occurred in dialysis facilities. Hepatitis B virus nosocomial transmissions in hemodialysis units were the most common, but they also had the shortest duration and lowest frequency per outbreak (Nguyen *et al*., 2019).

The CDC received reports of 102 hepatitis C virus cases that contributed to hemodialysis facility outbreaks between 2008 and 2017. High hemodialysis unit hepatitis C virus prevalence is a significant risk factor for hepatitis C virus outbreaks (Soi and Soman, 2019; Espinosa *et al.*, 2004; Fissell *et al.*, 2004; Burdick *et al.*, 2003).

Outbreaks of viral hepatitis in hemodialysis units can usually be traced to breaches in the implementation of infection control measures. Often, multiple breaches across multiple infection control categories are found. Only a handful of cases of hepatitis C virus transmission via internal machine

pathways have been reported. The most likely source of hepatitis C virus transmission within hemodialysis units is external contamination of supplies, surfaces, and staff. Modes of external transmission include suboptimal disinfection, use of multidose drug vials, suboptimal injection safety, and direct contact between patients (Minutolo *et al.*, 2018; Fabrizi *et al.*, 2015; Mbaeyi and Thompson, 2013).

Patients should be examined at some points, such as before the start of dialysis, when switching HD units, when switching renal alternative therapy, periodically during HD, if exposed to blood or body fluid in the HD unit, and if a new condition is identified in the HD unit to detect viral hepatitis (Winston *et al.*, 2020).

Therefore, hemodialysis patients are at greater risk of contracting the hepatitis B virus, hepatitis C virus, and human immunodeficiency virus (HIV) than healthy individuals (Güvenir *et al*., 2019).

Nevertheless, hepatitis B virus and hepatitis C virus are transmitted parenterally and these viruses are a historical reason for associated diseases among hemodialysis patients. A high prevalence of hepatitis B and C is observed in hemodialysis centers worldwide. In general, these people are because of many risk factors for viral hepatitis B and C, including blood transfusions, medical procedures, and sharing of infected patients' environments (Fabrizi *et al.*, 2015).

Viral hepatitis infections are an important cause of morbidity and mortality in hemodialysis patients, and the prevalence varies among different areas of the world. Patients receiving continuous hemodialysis are at high risk of being infected with the hepatitis B virus and hepatitis C virus than the general population (Jasim and Athbi, 2015).

Hepatitis B (HBV) and hepatitis C virus (HCV) infections are important causes of morbidity and mortality among dialysis patients (HD) and create problems in the management of patients in dialysis units because patients with chronic renal failure do not clear this viral infection at all. About 200 million people are infected with the hepatitis C virus worldwide, with a serovirus infection rate of between 3 and 4% reported in Asian countries, while in Central Africa and Egypt, it is 10-20% (Abdel-Hamid *et al.*, 2007)

Bloodstream infections may occur because of unsafe practices such as syringe reuse between patients, intravenous fluid and medication vial contamination, and lack of adherence to safe injection practices (Lindberg *et al.*, 2013).

In Arab countries, the prevalence of HBV among HD patients ranged from 2% in Morocco to 11.8% in Bahrain, and the prevalence of HCV among HD patients has been reported to range from 27% in Lebanon to 75% in Syria (El-Ottol *et al*., 2010).

In the USA and Taiwan, the prevalence of HBV infection among patients undergoing long-term HD was 0.9% and 16.8% respectively (Idrees *et al.,* 2011*).*

In Brazil, HBV infection in HD centers varies from 7.5 to 28.0% (Carrilho *et al.*, 2004).

Within India, there is a very wide range of prevalence rates for HBV (3.4-46%), and HCV (4.3-45.2%) in the dialysis population. These prevalence rates are higher than the average prevalence rates estimated for the general population in India (4.7% and 1.85% for HBV and HCV, respectively) (Chawla *et al.*, 2005).

In Iraq, the prevalence of HCV infections varies from 7.1% in the Iraqi renal transplant center in Baghdad (Khattab, 2008), to 26.7% and 11.7% in the Sulaimani dialysis unit and Al-Anbar governorate respectively (Ramzi *et al.*, 2010).

2.2.1. Hepatitis B

Hepatitis B is an infectious liver disease, caused by hepatitis B virus infection. It can be a mild disease that lasts a few weeks or a serious disease for life. It can be either "sharp" or "chronic." HBV is a deoxyribonucleic acid (DNA) virus that is transmitted primarily by blood (by-skin and per mucosal). It has been found in blood, saliva, seminal and vaginal discharge and can be transmitted through mucous membranes and breaks in the skin. The Hepatitis B virus is additionally transmitted from pregnant mothers to their babies at birth and through close contact afterward. Hepatitis B virus is often transmitted in many ways: needle sticks, body piercing, using unsterile instruments, dialysis, sexual contact, and even less intimate close contact (Chang, 2007; Smeltzer and Saddarth, 2010).

Hepatitis B infection is the tenth leading cause of death globally and one of the most important infectious diseases affecting all countries, especially in developing countries (Abeje and Azage, 2015). In the world, two-billion people are estimated to be infected with the hepatitis B virus (HBV) and about 360 to 400 million people are chronically infected (Ogoina *et al.*, 2014).

Hepatitis B is an infectious disease caused by the hepatitis B virus (HBV) that affects the liver. It can cause both acute and chronic infections. Many people have no symptoms during the initial infection. Some develop a rapid onset of sickness with vomiting, yellowish skin, tiredness, dark urine and abdominal pain. Often, these symptoms last a few weeks and rarely does the initial infection result in death (Rubin *et al.*,

2008). Moreover, symptoms of HB may take 30 to 180 days to begin. In those who get infected around the time of birth, 90% develop chronic hepatitis B, while less than 10% of those infected after the age of five do. Most people with chronic diseases have no symptoms. However, cirrhosis and liver cancer may eventually develop. Cirrhosis or liver cancer occurs in about 25% of those with chronic disease (Chang, 2007; Study, 2016).

The hepatitis B surface antigen (HBsAg) has been detected on several utility surfaces, such as door handles, clamps, scissors, and machine control panels. The infection can be transmitted to patients directly through contaminated equipment, and staff can transport the infection indirectly (Winston *et al*., 2020; Minutolo *et al.*, 2018; Fabrizi *et al*., 2015; Alter *et al*., 2001).

2.2.1. A. Clinical Manifestations

Clinically, HBV closely resembles HAV, but the incubation time period is much longer (one to six months). The signs and symptoms of HBV are often insidious and variable. Fever and respiratory symptoms are rare; some patients have rashes. The patient may have anorexia, abdominal pain, generalized pain, malaise, and weakness. Jaundice may or may not be clear. If jaundice occurs, light-colored stool and dark urine are the accompaniments. The liver could also be tender and swell to 12 to 14 cm vertically. The spleen is enlarged and palpable in an exceedingly small number of patients. Enlarged posterior cervical lymph nodes can also have subclinical episodes that occur more often(Hinkle *et al*., 2018).

2.2.1. B. Prevention of hepatitis B

The main tools for preventing viral hepatitis transmission include vaccination, screening, and treatment. The hepatitis B vaccine has been

associated with a global decline in HBV, one of the most effective preventive interventions against hepatitis B virus transmission. CDC guidelines recommend that all health-care workers be vaccinated against the hepatitis B virus, and in the case of chronic infection, comprehensive precautions are sufficient to control infection. In 2002, hemodialysis patients were 56% under-vaccinated against the hepatitis B virus. A recent sub-study found a coverage rate below the optimal level of 45% of the HBV vaccine series in Medicare recipients who started dialysis in 2006-2015 (Abara *et al.*, 2017; Shen *et al.*, 2017; Mbaeyi and Thompson, 2013; Holmberg *et al*., 2012).

Continued screening of blood donors for the presence of hepatitis B antigen (HBAg) further decreases the danger of transmission by transfusion. The use of disposable syringes, needles, and the introduction of needleless intravenous administration systems have reduced the danger of spreading this infection from one patient to another or to health care personnel during the gathering of blood samples or the administration of parenteral therapy. Within the clinical laboratory and also the hemodialysis unit, work areas are disinfected daily. Additionally, gloves are worn when handling all blood and body fluids, additionally, (HBAg) positive specimens, or when there is potential exposure to blood (e.g., blood drawing) or to patients' secretions. Eating is prohibited within the laboratory and in other areas exposed to secretions, blood, or blood products. Patient education regarding the character of the disease, its infectiousness, and the prognosis is a critical factor in preventing transmission and protecting contacts advised to avoid high-risk behaviors (Smeltzer and Saddarth, 2010).

2.2.1. C. Preventing Transmission

- Avoid multidose vials in patient care settings.
- Monitor cleaning, disinfection, and sterilization of reusable devices in patient care settings.

- Recommend vaccination for peoples at risk for infection by percutaneous or mucosal exposure to blood.
- Use barrier precautions in situations of contact with blood or body fluids.
- Use needleless IV and injection systems in health care.
- Use standard precautions in clinical care(Ferguson, 2014).

2.2.1. D. Active Immunization: Hepatitis B Vaccine

Active immunization is usually recommended for people who are at high risk for viral hepatitis B (eg, health care personnel, hemodialysis patients). A yeast-recombinant viral hepatitis B vaccine (Recombivax HB) is used to produce active immunity and has shown rates of protection greater than 90% in healthy people (Dan *et al*., 2015; Bennett *et al*., 2014).

Although antibody levels may become low or undetectable, immunologic memory may remain intact for a minimum of 5 to 10 years. Measurable levels of antibodies might not be essential for cover. In general, in those with normal immune systems, booster doses don't seem to be required, and no data supports the employment of booster doses of hepatitis B vaccine among immunocompetent individuals who have responded to the vaccination series. However, booster doses are recommended for people who are immunocompromised (Chan *et al.*, 2016).

A viral hepatitis B vaccine prepared from the plasma of humans chronically infected with HBV is employed only rarely in patients who are immunodeficient or allergic to recombinant yeast-derived vaccines. Both forms of the viral hepatitis B vaccine are administered intramuscularly in three doses; the second and third doses are one and six months, respectively, after the primary dose. The third dose is important in producing prolonged immunity. The Viral Hepatitis B vaccination should be given to adults in the deltoid muscle. The antibody response is also measured by anti-HBs levels

one to three months after completion of the essential course of vaccine, but this testing isn't routine and is not currently recommended. People that don't respond may benefit from 1 to 3 additional doses. People at high risk, including nurses and other health care personnel exposed to blood or blood products, should receive an active immunization (Bernieh, 2015).

Health care workers who come into contact with blood are screened for anti-HBs to determine whether immunity is already present from previous exposure. The vaccine produces acquired immunity to HBV in 90% to 95% of healthy people. It doesn't provide protection to those exposed to HBV, nor does it provide protection against other types of viral hepatitis (Dan *et al*., 2015).

Infection with HBV may be a public health problem that will predispose to deleterious consequences like liver failure and carcinoma. It's estimated that approximately 400 million people are chronically infected with the virus (Shepard *et al*., 2006).

The prevalence of HBV differs from one country to another, ranging from less than 1% in some Western countries to up to 10% in East Asia. In Iraq, the prevalence of HBV was studied previously, and it started from around 1% in the northern region to 3.5% in the south (Hussein, 2015).

Hepatitis B infection may be a serious pathological state worldwide. Prevention of this disease with its fatal consequences depends greatly on the amount of adolescents' knowledge, attitudes, and preventive measures about it (Hassan and Amin, 2017).

2.2.2. Hepatitis C

2.2.2. A. Clinical Manifestations

Hepatitis C is an infectious disease caused by the hepatitis C virus that primarily affects the liver; it's a type of hepatitis. During the primary

infection, people may have mild or no symptoms. Occasionally, a fever, dark urine, abdominal pain, and yellow skin occur. The virus persists within the liver in about 75% to 85% of those initially infected. Early on, chronic infections typically have no symptoms. Over a few years, however, it often results in disease and, infrequently, cirrhosis. In some cases, those with cirrhosis will develop serious complications like liver failure, cancer of the liver, or dilated blood vessels within the esophagus and stomach (Ryan and Ray, 2004).

The Hepatitis C virus is spread by blood-to-blood contact due to intravenous drug use, medical equipment poorly sterilized, injuries from needle sticks in healthcare, and blood transfusions. Using blood screening, the risk of a blood transfusion is less than one per two million. It is also spread from an infected mother to her baby during birth. It's not spread by superficial contact. It's one of five known hepatitis viruses: A, B, C, D, and E. Diagnosis is by blood testing to look for either antibodies to the virus or it's RNA. Testing is usually recommended for all people who are in danger (Tordrup *et al.*, 2019; Schillie *et al.*, 2020).

2.2.2. B. Prevention of hepatitis C

• Advise avoidance of high-risk behaviors like intravenous drug use.

• Avoid multidose vials in the inpatient care room

• Monitor cleaning, disinfection, and sterilization of devices in the inpatient care room.

• In situations of contact with blood or body fluids, use barrier precautions.

• Use needleless intravenous and injection systems in health care.

• Use standard precautions in clinical care (Ferri, 2010).

Hepatitis C virus ribonucleic acid (RNA) has been detected on the hands of nurses dialyzing infected patients (Alfurayh *et al.*, 2000).

The prevalence of HCV infection is higher among HD patients than in the general population, and several routes of transmission are thought to originate from HD units. Although HCV transmission through blood products was previously a significant source of infection, current cases are more likely related to nosocomial exposure, previous blood transfusions, mode of dialysis therapy, and duration of hemodialysis (Shihab *et al*., 2014).

Hemodialysis units are considered high-risk units where Blood Stream Infections are common. The Hepatitis C Virus is one of the bloodstream infections that is endemic in hemodialysis units in Middle Eastern countries, especially in Egypt. Bloodstream infections may occur because of unsafe practices such as syringe reuse between patients, intravenous fluid and medication vial contamination, and lack of adherence to safe injection practices (Lindberg et al., 2013; Ahmed *et al.*, 2010).

2.3. Preventive measures regarding hepatitis B& C in hemodialysis units

Infection is the most common cause of death in hospitals and the second most common cause of death among hemodialysis patients (HD), after cardiovascular disease. HD patients as well as dialysis staff are at risk of healthcare-related infections (HAIs) due to frequent and prolonged exposure to many potential contaminants in the dialysis environment. The extra-body nature of the treatment, the associated combined environmental conditions, and the immune risk status of HD patients are the main factors that prepare. The apparent increase in the likelihood of transmission in high-resolution environments has led to the development and implementation of

specific and stricter infection prevention and control measures in addition to the usual standard precautions (Karkar *et al*., 2014).

Measures or steps taken to prevent illness rather than treat it are referred to as preventive health measures. Preventive health measures cover a wide range of interventions that can be used to prevent or delay the onset of disease, as well as to minimize disease transmission and exposure. Many preventive health measures have been identified as a cost-effective way to identify and treat potential health problems before they develop or worsen (Elliott *et al*., 2017).

Most people (over 90%) who are infected with the hepatitis B virus develop antibodies and recover automatically in 6 months. The mortality rate from acute hepatitis B virus has been reported to have risen to 1%. Another 10% of patients who have HBV progress to the carrier state or develop chronic hepatitis with persistent hepatitis B virus infection, liver infection, and inflammation. It remains one of the leading causes of cirrhosis and hepatic cell carcinoma (HCC) worldwide with high mortality rates. In fact, approximately 15% of those who develop chronic hepatitis B during adulthood die from cirrhosis or liver cancer. Those who develop a chronic infection as a child have a 25% higher mortality rate (Papadakis, 2016; Dan *et al*., 2015; McMahon, 2014).

Studying the prevalence of hepatitis C and hepatitis B infections and potential risk factors among high-risk HD patients are the keys to developing the necessary evidence base before prevention, treatment, and control plans can be introduced and adopted by caregivers and decision-makers alike to reduce the spread and recycling of the disease and ultimately reduce morbidity and mortality (Gasim *et al.*, 2012).

Hepatitis B vaccination of dialysis unit staff has been shown to be effective in reducing hepatitis B infection among these staff (Bernieh, 2015).

In Brazil, over the past 20 years, public policies, infection control, and prevention measures have been integrated into the routine of dialysis centers. Monitoring of patients with viral hepatitis has become mandatory; the hepatitis B vaccine has become mandatory for all dialysis patients and health professionals. Hepatitis B surface antigen (HBsAg) patients are dialyzed in a separate room, machine, and exclusive individuals. However, information on the impact of these measures on the spread of hepatitis B and C in the country's dialysis centers is rare (Carneiro *et al.*, 2005).

However, hepatitis B, unlike the hepatitis C virus, hepatitis B virus infection can be prevented by vaccination. The Hepatitis B virus vaccine has been provided and recommended for all dialysis patients since the 1980s. However, this virus remains a major public health problem, particularly in developing countries with limited resources for dialysis patients, and is attended by health professionals less compliant with infection prevention and control measures (Duong and McLaws, 2017; Bernieh, 2015).

Studies indicate that the adoption of specific infection control and prevention measures at dialysis centers contributes decisively to reducing rates of hepatitis B virus infection and hepatitis C virus infections during dialysis. In the United States of America, in the early 1970s, the incidence of hepatitis B virus infection among chronic hemodialysis patients was 6.2%. It dropped to 1% by 1980 after the adoption of control and prevention measures, and to 0.06% in 1999 after the inclusion of the hepatitis B vaccine (Prevention, 2001).

Preventive measures for hepatitis B virus infection include vaccination against this virus, proper screening of donated blood products, separation of HBV-specific dialysis machines, and periodic testing of surface hepatitis B antigens (HBsAg) and HBV antibodies, while the transmission of hepatitis C virus within the dialysis environment can be

reduced by strict adherence to the recommended infection control precautions for HD patients (Elamin and Abu-Aisha, 2011).

Infection is the number one cause of hospitalization and the second most common cause of death among HD patients. Infection control in dialysis units remains the most important measure to maintain a healthy environment and prevent the spread of infection among immunosuppressive patients (Karkar, 2018).

Patients on hemodialysis are exposed to multiple types of infections, including bloodstream infections and topical infections of access to blood vessels; blood-borne infections with hepatitis B virus and hepatitis C virus. Sources of infection include contaminated water, equipment, environmental surfaces, and infected patients. Contaminated hands of health care workers are among the most common means of health-care-related transmission. In fact, hand hygiene is chosen as the most important intervention to prevent infection. The apparent increase in the potential for transmission in the HD environment has led to the establishment and implementation of specific and stricter infection prevention and control measures in addition to the usual standard precautions (Karkar *et al*., 2014).

Infection control measures were responsible for the decreased prevalence of hepatitis B virus and hepatitis C virus infections in dialysis patients (Cordeiro *et al.*, 2018).

Kidney units should develop protocols for cleaning and disinfecting exposed surfaces and equipment in the dialysis unit with neutral detergents and hot water and thoroughly drying them between patient treatments. For each chemical cleaning and disinfection agent, the units must follow the manufacturer's instructions for appropriate mitigation and contact time. The time between shifts should be sufficient to enable effective decontamination of machines and surfaces. Any blood spill should be cleaned immediately

with a cloth wet with antimicrobial or bleaching disinfectant. The shared equipment should be cleaned in accordance with the instructions of the manufacturers (Kroes *et al.*, 2006).

2.4. Prevention of BBV infection in the hemodialysis units

2.4.1. Infection prevention and control program

Each healthcare facility's infection control division or committee may run an infection prevention and management program, including an infection risk assessment, to reduce or mitigate healthcare-associated infections in the hemodialysis room. If the healthcare facility does not have an infection control division or committee, the program will be managed by the facility's chief executive officer, and personnel in the hemodialysis room should obey the program's rules and procedures (Council, 2010).

In addition, infection surveillance and monitoring procedures, strategy development to reduce or decrease the risk of infection, and assessment and feedback processes for redesigning and implementing the updated program should all be included in the infection prevention and management program. The dialysis room should be monitored for a period of time to identify infection control issues such as units, infection sites, and microorganisms (WHO, 2016).

Ongoing surveillance activities may identify health-related events or issues, allowing for the development of recommendations and action plans to reduce infection transmission and future incidents. The outcomes of these activities should be communicated to the clinical staff and reported to the leadership. Employee education and the development of corrective actions should accompany surveillance and monitoring operations. Surveillance activities may reveal issues that can be addressed during the quality improvement process (Zingg *et al.*, 2015; Friedman *et al.*, 2008).

2.4.2. Management of outbreaks

A sudden increase in the occurrence of infection or colonization at a specific time and location, or the sudden occurrence of an unusual disease, is known as an outbreak. Infectious disease outbreaks or epidemics should be reported to the dialysis room's supervisor. An outbreak should be reported to the infection control division or committee as soon as possible. The infection control division or committee should investigate the outbreak thoroughly and provide the dialysis room staff with the necessary infection control measures. Employees in the dialysis room should work with the infection control division or committee to implement infection control and prevention measures. If the healthcare facility does not have an infection control division or committee, the director of the facility may take on this responsibility. In the event of epidemics or national disasters caused by infectious diseases, a rapid response system should be created (Bryant *et al*., 2016; Council, 2010).

Hand hygiene is a broad term that encompasses hand washing as well as hand antisepsis. Hand washing is the act of washing one's hands with soap and water, while hand antisepsis is the use of hand sanitizers for rubbing or handwashing in order to reduce microbes on the hands or prevent microbial development. Hand antisepsis can be done even if there is no visible contamination, while hand washing can be done if the hands are visibly contaminated. Hand hygiene can't be replaced by wearing gloves. Hand hygiene should be practiced by not only hemodialysis patients but also their families and visitors before entering the hemodialysis room (Deryabina *et al.*, 2021; WHO, 2020; Park *et al.*, 2018; WHO, 2018).

Isolation is performed to prevent infection or the transmission of microorganisms from confirmed or suspected cases of infection to other patients or staff. To minimize the exposure to and transmission of infections

in hemodialysis units, each unit should implement infection prevention and control measures systematically based on standard, contact, droplet, or aerosol precautions. A standard precaution is a practice designed to prevent the transmission of an infection by contact with body fluids. The concept of a standard precaution is based on the principle that any blood, body fluid, secretion, or excretion from any patient may contain transmissible infectious agents. Standard precautions involve the use of personal protective equipment (PPE) such as masks, face shields, gowns, and gloves. In hemodialysis settings, the risk of exposure to blood and blood-borne pathogens is increased because the bloodstream is accessed during the dialysis session. Therefore, more rigorous steps to protect personnel and patients from infection sources should be followed (Siegel *et al.*, 2007).

The only way to prevent blood-borne virus transmission is to take comprehensive infection control measures. Health-protective precautions must be included in infection control measures to prevent the direct or indirect transfer of blood or blood-contaminated fluids to patients through contaminated equipment or surfaces. Infection control measures must include health-protective measures that prevent the direct or indirect transmission of blood or blood-contaminated fluids to patients through contaminated equipment or surfaces (Council, 2010).

The transmission of BBV is facilitated by the dialysis process because of the considerable potential for exposure to blood. Blood borne viruses can remain potentially infective on clinical equipment surfaces through blood splashes which will not be visible to the eye. Hepatitis C viruses (RNA) has been detected on the hands of nurses dialyzing infected patients. Whilst HBV and HCV have been detected in the dialysate of patients known to have these infections, the internal fluid pathways have no evidence to offer a viable route for transmission of BBV. Standard precautions are a collection of

infection control practices used to prevent the transmission of diseases that may be obtained through contact with blood, body fluids, improper skin (including rashes), and mucous membranes. Infection control measures should be used when providing care to all people, whether or not they are infected or symptomatic (Garthwaite *et al.*, 2019).

2.5. Preventive measures and precaution

Standard Precautions (SP) are infection-prevention procedures that extend to all patient care, regardless of whether the patient is suspected or confirmed to have an infection (Esmail *et al*, 2019).

The primary route of transmission of health-care-associated infections (HAIs) is through health-care workers' (HCWs) transiently infected hands. Hand hygiene is the most important way to control hospital infections due to the critical role of nurses in patient care (Asadollahi *et al.*, 2015).

As a result, hand hygiene is known as the most effective infection-prevention method. HCWs, on the other hand, have very low hand hygiene enforcement rates, with an overall average of just 40%, centered on the Association of Professionals in Infection Control (APIC), the Centers for Disease Control and Prevention (CDC), and the World Health Organization (WHO) (Shimokura *et al.*, 2006).

When multiplied by the number of patients allocated to each staff member, the average number is at least 60-100 times higher (e.g., two to three patients). The high frequency at which hemodialysis workers must conduct hand hygiene may be a factor in noncompliance. Continuous education and monitoring, as well as having a sufficient number of sinks with soap dispensers, paper towels, hand lotions (e.g., one for every two or four dialysis stations), and an alcohol-based hand rub at each patient station, will boost compliance (Boyce and Pittet, 2002)

Other preventive measures include restriction of having long nails and wearing of artificial fingernails or extenders by health-care personnel who provide direct patient care, as artificial nails could harbor gram negative bacilli and yeasts (Alter *et al.*, 2001).

Personal protective equipment (PPE) refers to a variety of barriers and respirators used alone or in combination to protect mucous membranes, airways, skin and clothing from contact with infectious agents. They include gloves, gowns, masks, eye goggles, face shields, and respirators. In the HD setting, gloves are recommended to be worn whenever caring for a dialysis patient, whether touching the patient's intact skin (e.g., taking blood pressure) or the patient's equipment at the dialysis station. Gloves should be removed and followed by hand hygiene between patients or stations (Cole and Jackson, 2010).

The recommended practice of glove use for every contact with the patient (s) and equipment (s) at the dialysis station requires an enormous amount of glove supply, which is not always realistic in many HD units. However, when visible soiling is present and/or contact precautions are indicated, wearing gloves is a must. Sterile gloves must be used during procedures requiring a sterile aseptic technique, such as during catheter insertion or at any time a dialysis catheter is handled/manipulated (Fuller *et al.*, 2011).

In addition, wearing gowns over uniforms and using a face mask, eyeglasses or face shield when performing procedures in which blood can be expected to be sprayed, especially during the onset and cessation of dialysis, if a face protector is used while handling the catheter, a surgical mask should be worn under it to protect the patient from the respiratory drops in HCW. Equally important is the fact that the patient must also wear a mask and be asked to turn his face away from the catheter site to reduce the contamination of the infectious drops. Moreover, wearing a mask is important when a staff

member, patient, or visitor has a cold or cough (Wienaer *et al.*, 2011; Cole and Jackson, 2010; Wilson *et al.*, 2007; Gilmore, 2006).

2.5.1. Universal precautions include:

- Hand washing after contact with the patient, after contact with blood, body fluids, or surfaces
- Supplies that may be contaminated with blood.
- Disposable gloves are worn when caring for the patient or touching equipment; changing gloves and washing hands between patients.
- Wearing disposable plastic aprons.
- Impervious dresses when sprayed with blood or body fluids may occur.
- Eye protection (convictions, goggles, or safety goggles) when dealing with blood, body fluids, or debris. Contaminated tissue aircraft may splash in the face.
- Employees who cover any cuts or abrasions with prompt and safe water plasters to get rid of sharp boxes protective of proper piercings do not fill sharp containers (should not be filled to more than two-thirds of capacity).
- Never re-sheath the needles.
- Disposing of unused medications/supplies (syringes/swabs) taken to a dialysis station.
- Inspection of dialysis machines, including transducer protectors, for contamination with blood.
- Cleaning and disinfection of surfaces at the dialysis station.

- Adequate separation of clean supplies from contaminated materials and equipment Disposal of unused medicines/supplies (syringes/swabs) taken to the dialysis station.
- Examination of the dialysis machine, including the protection of contamination with blood.
- Hygiene and disinfection of surfaces at the dialysis station.
- Adequate separation for clean supplies of contaminated materials and equipment.

These precautions' implementation will require a plentiful supply of protective equipment, adequate handwashing facilities, and adequate nursing and cleaning staff (Work, 2018; Wheeler and Winkelmayer, 2008).

Special attention should be paid to the design of the dialysis unit; lighting, "traffic" flow, heat, and noise. Deficiencies in these areas can increase the risk of accidental exposure to blood. There should be sufficient space between the beds for staff to perform their clinical duties in a safe manner. Every effort should be made to avoid staff rushing to clinical care, to reduce the possibility of accidental blood transfusion from one patient to another. The registration of machine numbers and, therefore, the position of machines for every dialysis session should be considered if possible, as this facilitates examination in at-risk populations in the event of a new coup. It is recommended that units adopt strategies to reduce patient movement between dialysis machines so, in the case of a serological coup, exposed numbers are reduced. Studies conducted in Italian and Saudi dialysis centers have revealed a significant link between infection and outbreaks of hepatitis C and the level of staffing, suggesting that inadequate staffing plays a role in transmission (Petrosillo *et al.*, 2001; Alter and Tokars, 2001).

Kidney units should develop protocols for cleaning and disinfecting exposed surfaces and equipment in the dialysis unit with neutral detergents and hot water and thoroughly drying them between patient treatments. For each chemical cleaning and disinfection agent, the units must follow the manufacturer's instructions for appropriate mitigation and contact time. The time between shifts should be sufficient to enable effective decontamination of machines and surfaces. Any blood spill should be cleaned immediately with a cloth wet with antimicrobial or bleaching disinfectant. The common equipment should be cleaned in accordance with the manufacturer's instructions (Saxena and Panhotra, 2004).

2.5.2. Dialysis equipment and BBV infection

After each dialysis session, clean and disinfect the external surfaces of the HD machine with a low-level disinfectant or any registered disinfectant solution marked for use in the healthcare environment for use on non-critical products (including HD machines) according to the product manufacturer's guidelines. The impact of disinfectants will be reduced or disabled if there is a bioburden. As a consequence, if there are observable blood leaks or other infectious substances on the exterior of the HD system, they should be washed separately until the disinfectant solution is applied. All of the machine's outer surfaces, especially the front panel, which has been touched frequently, as well as the venous column, hand, and back bases, should be carefully disinfected using friction and dry air. All towels or wipes and blood-contaminated gloves should be disposed of in a critical hazard waste container. Clean hand hygiene should be performed after glove removal (Karkar *et al*., 2014; Rutala and Weber, 2008; Alter *et al*., 2001).

CDC and APIC guidelines do not suggest disinfecting the internal fluid pathways of "single-scroll" HD machines between the patient's uses, except when a blood leak occurs. Routine disinfection and rinsing are

recommended at the beginning or end of the day (or as recommended by the device manufacturer). EBPG recommends routine cleaning of a high-definition machine after each dialysis session, either with heat or a chemical agent. Chemical cleansing is recommended before the patient uses backup machines, which can be inactive for variable periods of time and possibly develop bacterial growth. The chemical disinfection protocol must be in accordance with the recommendation of the manufacturer of the device, including concentration and time of residence (Kessler *et al.*, 2002).

Separation of machines must be used for patients known to be infected with HBV (or at high risk of new HBV infection). A machine that has been used for patients infected with HBV can only be used again for non-infected patients after it has been decontaminated using a process recognized to be effective against HBV. Healthcare workers dialyzing patients with known HBV infection should not dialyze patients without HBV infection at the same time (Garthwaite *et al.*, 2019).

Hepatitis B virus is very infectious with a much higher concentration of viral particles in an infected patient compared to an infected hepatitis C virus. A non-immune patient with untreated transdermal exposure to an infected source carries a risk of serological transformation of up to 30%. HBsAg positive patients who are positive for hepatitis B viral load antigens are particularly high in their blood and are likely to have significant levels of hepatitis virus in body fluids containing serum or blood. Hepatitis B virus is relatively stable within the environment and has been shown to remain viable for at least seven days on environmental surfaces (including clamps, scissors, dialysis machine control buttons, and door handles) at room temperature in the absence of visible blood and still contains high viral titers. There is strong epidemiological evidence that the separation of dialysis patients infected

with the hepatitis B virus reduces the transmission of the hepatitis B virus among dialysis patients (Moloughney, 2001).

For these reasons, patients with chronic hepatitis B virus infection (Positive HBsAg or evidence of viral DNA circulating) must be dialyzed using custom dialysis machines and staff, in a separate area or rooms, with no sharing of tools, medicines, and supplies among patients, regardless of the condition of the serological. The separate area refers to an area with physical barriers such as walls or screens that ensure there's no possibility of traffic between affected areas and clean areas. Environmental surfaces, including dialysis/bed chairs, HD machine external surfaces, clamps, etc., must be thoroughly disinfected using a recognized process to be effective against HBV after each use (Froio *et al.*, 2003).

Standard machine disinfection among patients does not eliminate the risk of hepatitis B virus transmission. The device used for patients with hepatitis B virus can be used again for patients who are not infected only after they have been thoroughly disinfected using a recognized process to be effective against HBV. A local decontamination protocol should be developed, taking into account the manufacturer's instructions, the design of the device, and the use of double transducer protectors. The pressure adapter ports must be removed after each use unless double transducer protectors are routinely used. If the device does not automatically disinfect Hansen connectors, they should be disinfected manually. If it is known that the machine's residence contains points prone to blood leakage, it should be examined and disinfected (Zuñiga *et al.*, 2016).

Dedicated machines are not required for patients with hepatitis C, provided that clean-up and disinfection procedures are strictly adhered to among patients. There is no evidence to support the use of dialysis machines for patients with hepatitis C virus (Isakova *et al.*, 2017).

The transmission of the hepatitis C virus has not been demonstrated through the internal pathways of modern single-pass dialysis machines. The transmission of the virus will require the crossing of the dialyzer membrane intact, migration from drain tubes to a fresh dialysate circuit, and passage through the dialyzer membrane of a second patient, although the virus, even in the case of blood leakage, can't cross the intact membrane. The transmission needs HCV to reach the fresh dialysate used for a later patient and enter the blood circulation of this patient through back filtration via the dialyzer membrane. This very low theoretical risk of hepatitis virus transmission through the dialysis circuit can be eliminated completely by using dual adapter protectors for patients who are hepatitis C positive. In isolated cases of hepatitis C, virus transmission can't exclude the role of the dialysis circuit, but environmental surfaces are more likely to contribute to transmission. The use of dedicated dialysis machines for individuals infected with the hepatitis C virus was not recommended. Isolation of patients infected with the hepatitis C virus during HD is absolutely necessary to prevent direct or indirect transmission of the hepatitis C virus. However, due to the low prevalence of HCV in dialysis patients, it would be reasonable for individual units to consider isolating patients who have positive HCV RNA if facilities are available. This should not be at the expense of comprehensive, and strict infection control procedures (Thomson *et al.*, 2011; Lindley *et al.*, 2011).

External transducer protectors on blood pressure monitoring lines should be checked by health care staff during and after each dialysis session. If there is evidence of blood leak or saline, then the device should be taken from service and components of the device that may have come into contact with the blood should be replaced or disinfected by qualified staff in accordance with a protocol that includes the instructions of the manufacturers, because transducers serve an important role in monitoring the

pressures within the arterial and venous circuits. Transducer filter protectors play as a barrier between the tubing blood and the internal transducer in the machine. Hemodialysis machines have external (typically supplied with the blood tubing set) and internal protectors, with the internal protector serving as a backup in case the external transducer protector fails. Because transducers serve an important role in monitoring pressures within arterial and backward circuits. Membrane transducers filter protectors act as a barrier between the blood in the tubes and the internal transducer in the device (Garthwaite *et al.*, 2019).

Moisture can damage the pressure transducer. Therefore, the leakage of these filters can occur, especially if they are wet with saline or blood, which may endanger the safety of the candidate. The lack of use of an external protector or replacement of the protector when it becomes contaminated can contaminate the internal transducer protector, which in turn can allow the transmission of blood-borne pathogens (Brunet *et al.*, 2005).

Immediately, wet external transducer protectors must be changed, and also, the machine side of the protector should be investigated for contamination or wetting. If a fluid breakthrough is found on the removed transducer protector, the machine's internal transducer protector must be inspected by a professional technician, for safety, quality, and infection control purposes. In the unlikely event that the internal filter ruptures, the machine should be taken out of service and decontaminated according to a local protocol that follows the manufacturer's instructions (Delarocque *et al.*, 2002).

The moisture of external transducer protectors should be immediately changed, and the machine side of the protector should be checked for contamination or wetting. If fluid penetration is found on the removed

transducer protector, the internal transducer protector of the machine must be checked by a qualified technician, for safety, quality, and infection control purposes. In the unlikely event that the internal filter ruptures, the device must be removed from service and decontaminated in accordance with a local protocol that includes manufacturer guidelines (Garthwaite *et al.*, 2019).

There are many measures that can reduce the risk of breaching these filters:

- Monitoring blood levels in arterial and venous drip chambers during a dialysis session with the required adjustment to prevent excess filling.
- Turn off the blood pump before resetting arterial or venous pressure alarms.
- Intravenous and arterial monitoring bloodlines clamped before removing them from the device at the end of a dialysis session.

Routinely, some units add a second external transducer protector filter in a series with a filter already equipped with a line of pressure control, minimizing the requirement for technical interventions that take the device out of service (Savey *et al.*, 2005).

2.5.3. Disinfection process for dialysis equipment

Dialysis machines clean among patients is a key element to reducing the risk of transmission of BBV in the units. Dialysis units must develop protocols for cleaning and disinfecting surfaces and equipment in the dialysis unit, including, where appropriate, precise mechanical cleaning before any disinfection. For each chemical cleaning and disinfection agent, units should follow the manufacturer's instructions for appropriate mitigation and contact

time. Internal fluid pathways must be cleaned according to the manufacturer's instructions (Brunet *et al.,* 2005).

2.5.4. Blood borne viruses surveillance for dialysis patients

The infection prevention program includes surveillance for infections and tracking adherence to prescribed infection prevention practices. A standardized and accredited monitoring protocol must be used universally by all dialysis facilities in order to enable fair comparison and review of monthly rates within the same facility or to create meaningful standards with other units/centers. A standardized healthcare-related infection control system, such as the CDC National Health Safety Network, will provide accurate and reliable data that can be used to define areas of concern, as it allows all participating facilities to strictly document all relevant inspection criteria (Karkar *et al*., 2014).

All patients who start dialysis (including patients with severe kidney injuries) or return to dialysis after another method of dialysis therapy should be known to be negative for HBsAg before starting dialysis in the main dialysis unit. HCV examined all patients who started dialysis or returned to dialysis after another method of dialysis therapy. Patients who have no specific risk factors for HCV can be examined by serological methods followed by a reflex nucleic acid test (NAT) if serology is reactive. Patients with persistent risk factors should be screened by NAT (Garthwaite *et al.*, 2019).

In addition, patients who need dialysis before the result of the HBsAg test are known to be dialyzed in an area that is separated from the main dialysis unit and the device should not be used for another patient until the result is known to be negative or the device has been thoroughly cleansed. The separation of infected and clean areas in the kidney unit is defined as "functionally complete with no possibility of traffic between the two". There

is a physical barrier such as walls or screens between these affected areas and the clean ones (Minuk *et al.*, 2004).

Patients on regular hemodialysis in the hospital who are immune to hepatitis B infection (annual anti-HBs titre antibodies > 100 mIU/ml), need to be tested for HBsAg every six months. Non-respondents and those who do not respond adequately should be tested at least every three months. There are challenges in implementing a testing system where different timings can be used depending on the antibody titres. For this reason, they prefer units to routinely test for HBsAg every three months. Patients on regular hospital dialysis, without any persistent risk factors specified for HCV, should have HCV antibody testing at least every three to six months. A specific patient screening plan should begin using Nucleic Acid Amplification Testing (NAT) for patients with ongoing HCV acquisition risks (Wheeler and Winkelmayer, 2008).

2.5.5. Segregation of patients infected or at risk of infection

Patients who do not consent to BBV surveillance should have dialysis in a segregated area unless they are known to be HBV immune in the previous six months. Patients who are known to be HBV immune in the previous six months do not consent to BBV surveillance. They should be managed in the same way as patients with HCV infection. BBV infections are asymptomatic in the majority of individuals, and therefore, a surveillance system is required to detect new BBV infections and implement measures to limit the opportunity for nosocomial spread. The frequency of surveillance testing should be determined in part by patient specific risk factors, the local prevalence and incidence of infection. Kidney failure is well established and, therefore, surveillance can be less frequent than in the most vulnerable countries. Monitoring should be enhanced if the general risk of the patient is

high or if the patient is exposed to an event that increases the risk (Chaves *et al.*, 2011).

Patients on regular hospital dialysis who are immune to hepatitis B infection (annual anti-HBs tester antibodies > 100 mIU/ml) only need to be tested for HBsAg once a year. However, antibodies can fall out over time, leading some patients to become unprotected. In a U.S. study, 8% of chronic dialysis patients became unprotected due to a decrease in antibody titers over a 12-month period. For this reason, this group of patients is tested on a six-month basis. For those who are not immune to HBV infection, HBsAg is tested at least every three months for normal-risk patients. HBsAg tests are sufficient to diagnose HBV infection in the majority of dialysis patients. However, the transmission of HBV infection (the presence of HBV DNA can be detected by PCR in real-time in the absence of detectable HbsAg) has been reported in 1.3-3.8% of chronic dialysis patients (Minuk *et al.*, 2004), although the risk in the UK is likely to be considerably lower. There are reports of transmission of HBV infection from patients with occult HBV infection, though, to date, not in association with hemodialysis (Liu *et al*., 2006).

Patients who have antibodies to the hepatitis B core antibody (Anti-HBC) are at an increased risk of viral reactivation compared to those who have negative core antibodies. This group of patients should be examined at least three times per month. The risk of reactivation of the virus increases during periods of immunosuppression. Vaccination and the use of antiviral prophylaxis in cases where the risk of reactivation is enhanced. HBsAg tests should not be performed within two weeks of receiving the hepatitis B vaccine as the test may detect the vaccine and cause concern about the presence of current infection (Valsamakis, 2007).

Patients who intend to contact outside their home country should conduct a risk assessment before traveling due to the possibility of contracting BBV abroad. Where exposure is considered likely, enhanced monitoring and testing for BBV patients should be planned and tested, and patients should undergo dialysis in a separate area (Rahnavardi *et al*., 2008).

Enhanced surveillance for patients with HBV is not required if they are immune with a HBsAb level > 100 mIU/mL in the last 12 months. However, antibody titres can fall over time, leading some patients to become unprotected. The monitoring of HBV is not required if the patient has immunity with a HBsAb level of > 100 mIU/mL in the past 12 months. However, antibodies can fall out over time, leading some patients to become unprotected. Testing for HBsAg and HCV RNA should be performed in hemodialysis patients with unexplained abnormal serum aminotransferase concentrations. A new BBV infection has been identified in a hemodialysis unit. Testing for viral RNA or DNA should be performed for patients who may have been exposed(Garthwaite *et al.*, 2019).

Detection of HCV RNA by PCR techniques has the advantage of significantly shortening the window period from infection to positive results compared to serological methods. HCV RNA may be detectable one to two weeks after infection, whereas detectable antibodies may take up to a year in immunocompromised individuals (Wheeler and Winkelmayer, 2008). Furthermore, some patients with HCV infection do not develop detectable antibodies. Testing for core antigens is also available in certain laboratories and includes the same period as RNA testing, but concerns about limits of sensitivity mean it's not recommended as a complete replacement for RNA testing currently (Fabrizi *et al.*, 2005; Couroucé *et al.*, 2000).

The acquisition of a new infection from BBV should prompt an emergency assessment of all other patients within the same facility to

identify additional cases. The virus status should be reviewed for all at-risk patients and all patients who aren't infected should be tested for BBV. The frequency of screening should be increased for a limited period. For instance, a monthly test for three months, followed by a test again in three months, and a resumption of the test every six months if no additional injuries are identified. Determining BBV transmission within the dialysis facility should prompt a reassessment of infection control practices and therefore the need for corrective action. All cases of BBV with new infections identified on the dialysis unit should be referred to the hepatology/virology team for consideration for treatment, to reduce the risk to the individual and the population (Mbaeyi and Thompson, 2013; Weinbaum *et al.*, 2008).

2.5.6. Isolation of patients known to be infected with Hepatitis B virus

The isolation of HBsAg positive patients in HD units was one of the main pillars for the prevention of the hepatitis B virus beginning in the 1970s, followed by the implementation of the first hepatitis B virus vaccination in 1981. The U.S. National Surveillance Data from 1976 to 1989 reported that in HD units that carried out HBV isolation, the transmission was much lower than in HD units that did not. These measures have been attributed to isolation with a 70%-80% reduction in HBV transmission in HD units. Studies conducted in multiple countries agree that isolation reduces transmission. The rate of HBV in HD units decreased from 6.2 percent in 1974 to 1 percent in 1980 to 0.06 percent in 1999. The U.S. National Monitoring Data reported a decrease in the incidence of hepatitis C in HD units from 0.96% to 0.34% per year for the period 1997-2004 (Awan *et al.*, 2019; Nguyen *et al*., 2019; Hallacak *et al.*, 2009; Alter *et al.*, 2001).

Isolation itself without the implementation of appropriate infection control practices and routine HBV screening is not effective in eliminating transmission. Improved universal precautions and disinfection of non-

disposable equipment, and increased use of disposable equipment have resulted in decreases in HBV and HCV prevalence in dialysis centers. In addition to the use of separate rooms, machines, equipment, medications, and staff for HBsAg-positive patients (Ditah *et al.*, 2014; Estebaaqn *et al*., 2008; Carneiro *et al.*, 2005).

Infected patients with HBV must be dialyzed in an area that is segregated from the main dialysis unit. Healthcare workers performing dialysis on patients infected with HBV infection should not dialyze patients without HBV infection at the same time. If this is not possible, they must wear PPE and ensure thorough decontamination before moving from one patient to the other (Garthwaite *et al.*, 2019).

There is ample evidence to suggest that 'horizontal' (patients do not share machines) and 'vertical' (patients sharing machines) HBV transmission occurs when patients infected with hepatitis B virus are contacted next to uninfected patients. The risk of hepatitis B transmission has been shown to be reduced if patients with hepatitis B virus are contacted in a separate area from the "clean" area of the dialysis unit. The transmission has been reported in cases where health workers take care of infected and uninfected patients on the same hemodialysis. This also applies to hepatitis B virus patients who undergo invasive procedures (such as central venous catheters) in the dialysis unit. These actions should take place in a separate area. BBV can remain infectious on the surfaces of clinical equipment, even when blood stains are not visible to the naked eye. No injection of unused equipment, swabs, spare catheter, atc, taken in the room where the procedure has occurred should be disposed of (Geddes *et al*., 2011; Fissell *et al.*, 2004).

Patients with HCV don't have to be dialyzed in a separate area, providing infection control and universal precautions can be properly adhered to. The nosocomial transmission risk is much lower for HCV than

for HBV. In an Italian study, HCV was detected on the outer surface of the inlet-outlet connector of the dialyzer used for HCV non-infected patients, but there were no patients becoming infected (Froio *et al.*, 2003). The data from the Dialysis Outcomes and Practice Patterns (DOPPS) study showed that HCV seroconversion was equivalent to whether patients with HCV were separated or not separated for hemodialysis (Fissell *et al.*, 2004).

Similarly, a multi-center Belgian prospective study showed that the re-enforcement of universal precautions without separation was sufficient to reduce the incidence of HCV infection from 1.41 to 0.8% and this is supported by other observational studies (Jadoul *et al.*, 2004; Taal and van Zyl-Smit, 2000).

Cross-contamination of surfaces and supplies due to a lack of infection control procedures is the most important factor in the transmission of the hepatitis C virus between patients treated in the same dialysis unit (Stragier and Jadoul, 2003).

There is no need for routine isolation of patients with the hepatitis C virus in a separate area to prevent the transmission of the hepatitis C virus. Observational studies that revealed a decrease in HCV transmission after isolation, studies with poor quality evidence (Harmankaya *et al.*, 2002), and the results are often compared to historical controls, making it unclear whether improvements are the result of isolation policies or at the same time raising awareness and promoting comprehensive infection control policies during studies (Agarwal *et al.*, 2009; Spada *et al.*, 2008; Shebeb *et al.*, 2006).

These observations are reconfirmed by numerous reports of the hepatitis C virus in dialysis units (Shamshirsaz *et al.*, 2004) emphasize the importance of local monitoring to implement infection control measures. There is evidence from areas with a high prevalence of HCV infection that separation is associated with a decrease in nasal infection, both from

randomized surveillance trials and monitoring studies, although insulation should not be seen as an alternative to strict pollution control measures (Saxena *et al.*, 2003).

In a low-prevalence country such as the UK, it seems reasonable to suggest that separation facilities should be given priority for patients with hepatitis B infection but be also used for patients with hepatitis C if there are concerns about the implementation of contamination control measures. For this reason, "pediatric patients" with any BBV are often dialyzed in a separate area. Every effort must be made to ensure that these measures are not compromised in the care of the patient being separated(Garthwaite *et al.*, 2019).

2.5.7. Immunization of patients against Hepatitis B virus

All patients requiring renal replacement therapy (RRT) dialysis or a transplant for kidney disease should be evaluated for current or past infection with hepatitis B, and HBV vaccination should be provided if referred to (Micozkadioglu *et al.*, 2007).

In renal failure, the muscular vaccine provides suboptimal immune protection: only 50%-73% of dialysis patients develop a sufficient number of antibodies protective antibodies to HBsAb (antibodies 10 mIU/mL). Preventive coverage increases to 86% when larger doses (40 mcg) and the fourth dose of a vaccine are added. However, this is still lower than the 90%-95% protection rates reached in the general adult population. It is important to vaccinate patients with chronic kidney disease early because their ability to achieve immune protection with the HBV vaccine decreases as the disease develops. The high rate of glomerular filtration is associated with a better response to vaccines. Vaccinating staff is also an important means of protecting the workforce and unprotected patients. In 2002, 90 percent of the

staff unit were vaccinated (Udomkarnjananun *et al.*, 2019) (Soi and Soman, 2019) (Schillie *et al.*, 2018) (Guimaraes *et al*., 2017).

The introduction of HBV immunization was associated with a reduction in the incidence of HBV infection in dialysis units. A randomized controlled trial of immunization suggested a reduction in HBV infection [98] and a case controlled study demonstrated a 70% reduction in HBV infection in patients who had received HBV immunization compared with those who had not (Bel'eed *et al.*, 2002).

A randomized controlled immunization trial indicated a decrease in hepatitis B virus infection and a controlled study showed a 70% reduction in hepatitis B virus infection in patients who received hepatitis B virus immunization compared to those who did not. Although the risk of hepatitis B infection is lower in peritoneal dialysis patients compared to patients planning peritoneal dialysis, they should also be immunized because there is a high enough probability that they will require dialysis at some point (Garthwaite *et al.*, 2019).

Previously, passive immunization with HBV immunoglobulin has been shown to be effective in reducing hepatitis B virus infection in patients and staff in dialysis units, but this has now been replaced by active immunization. HBV immunoglobulin is now available exclusively for post-exposure protection in a limited number of scenarios (Grzegorzewska, 2012).

The hepatitis B vaccine is not indicated for patients who currently have or confirm a previous hepatitis B virus infection. The presence of anti-HBc antibodies should not be taken in isolation as confirmation of previous hepatitis B virus infection. Patients who have been identified as positive underlying antibodies who are at risk of reactivation of HBV may need to be vaccinated. Patients routinely consider that they have had hepatitis B virus

transmission in the past and are not contagious to others, and there is growing evidence that these people may repeat or may begin to repeat under special conditions (immunosuppression). Any patient with a proven past hepatitis B virus infection who is on the way to being significantly immune to reactivation risk should have a preventive management plan with a hepatitis B specialist (Bel'eed *et al.*, 2002).

Although there is no documented harm associated with the administration of the HBV vaccine to patients with natural immunity. Patients who have a positive anti-HBs antibody and who have an HBc antibody that can usually be detected have normal immunity to HBV and therefore may not need vaccination. However, detection of essential hepatitis B antibodies should not be used in isolation to determine immunity or previous infections, and these patients may still need to be vaccinated (Micozkadioglu *et al*., 2007).

The need for pre-immunization screening for anti HBc to avoid unnecessary immunization should be guided by the likelihood that an individual has been exposed to HBV or previous vaccine, as a study in the USA suggests that pre-immunization screening is cost-effective only in populations in which the prevalence of HBV infection exceeds 30% (Garthwaite *et al.*, 2019).

The initial HBV immunization schedule should involve high doses, frequent doses, or both of the available preparations. The vaccines are administered intramuscularly as per their licensed route (deltoid) but, if sufficient expertise exists, the intradermal route may be simpler. There's a better balance to be had with frequent hospital attendance versus practical vaccination schedules. Although the schedules referred to provide immunity as quickly as possible, some flexibility around scheduling is possible. For example, vaccines that are given every three months are linked with

appointments. The vital element is to ensure that there's a gap of a minimum of four weeks between the primary and second vaccines. Extending the vaccine schedule prolongs the time to protection, but longer intervals between doses improve the immune reaction. Patients should be tested four to eight weeks after the initial immunization cycle for response guides, then annually with enhanced doses, as appropriate (Chau *et al.*, 2004; Micozkadioglu *et al.*, 2007).

There are many reports of increased immunization success if individual doses are used more than the vaccine, higher doses are given, and if the intradermal route is employed (Oguz *et al*., 2001). Most studies have shown that the double dose schedule of four doses over six months is over the normal schedule of three-dose immunization (Charest *et al*., 2000). This can be logistically easier than identifying non-responders to the three dosing schedules and giving an enhanced dose. There's some evidence that the HBV vaccine with Adjuvant ASO4 (Fendrix) is more immune than Engerix B (Tong *et al.*, 2005).

There has been interest recently in the addition of immunosuppressant to enhance the success of hepatitis B vaccination in patients with nephropathy and depressive disease (Froio *et al.*, 2003), but it's too early to form a firm recommendation, and reports, in some cases, have had conflicting conclusions (Evans *et al.*, 2000).

In 1992, WHO recommended widespread vaccination against the hepatitis B virus, and by 2003, 79 percent of members had done so. The United Kingdom adopted this approach in August 2017. Countries that have implemented this have seen exceptional falls in their childhood prevalence rates of the Hepatitis B virus (Avazova *et al.*, 2008).

Patients should be considered as "appropriate responders" if anti-HBs antiantibodies titre is > 100mIU/ml eight weeks after the completion of the

immunization schedule. Hepatitis B vaccination responders should receive another booster dose if the annual anti-HBs titre is <100mIU/ml. There is an ongoing debate about what constitutes a response to immunization. Traditionally, > 100mIU/ml was considered to grant immunity, but there is evidence that patients with a lower peak response (10-100mIU/ml) will not become chronic carriers of HBV (Moal *et al.*, 2006).

In a series of dialysis patients with anti-HBs antibody titres >10mIU/ml who received transplants from positive donors HBsAg, 67% were serologically positive for anti-HBc, suggesting that such an anti-HBs titre does not always protect against HBV infection in HD patients (Grzegorzewska, 2012).

2.5.7. a. Identification and management of 'responders' to the immunization program

Patients who respond to immunization don't maintain detectable antibodies in more than half of their dialysis. In one of the early randomized studies controlled for immunization, there were four cases of viral hepatitis B infection in dialysis patients who had a clear response to immunization but whose levels of antibodies had diminished, suggesting that the antibody control strategy and booster doses could be worthwhile (Garthwaite *et al.*, 2019).

A retrospective review of the 1990s convincingly showed a higher response in non-dialysis compared to dialysis patients (80% compared to 50% in one analysis (Nanivadekar, 2000). In 2003, Da Rosa *et al*. established in the future that the total fertility rate is an independent positive predictive variable of the vaccine in response to vaccination (DaRoza *et al.*, 2003).

2.5.7. b. Identification and management of 'non-responders' to the immunization program

Patients who did not respond to the immunization program should be considered as inadequate if the anti-HBs antibody titre is < 100mIU/ml eight weeks after the completion of the first full immunization schedule. Non-respondents should not receive any other vaccinations. The likelihood of benefiting is low, compared to the cost burden. However, there is some evidence that non-responders to a four-dose 40 mcg schedule may later respond to a large dose given intra-dermally. The non-responsive patient, who is therefore not immune to hepatitis B virus, should be advised on how to reduce the risk of exposure to hepatitis B virus and the recommended actions to be taken when possible exposure to hepatitis B (Fabrizi *et al.*, 2006; Sari and Taskapan, 2012).

2.5.7. c. Immunization of staff against the hepatitis B virus

Staff members who have clinical contact with patients should be immunized against HBV and demonstrate that they are immune to, and are not infected with HBV. Staff members who have a current infection with HBV require occupational health clearance and ongoing monitoring in order to perform clinical duties. They would not usually be employed to work clinically in a dialysis unit. A staff member who is not immune to HBV and is not HBV infected should not dialyze patients who are HBV infected (Bernieh, 2015).

Many reports of hepatitis B and hepatitis C virus outbreaks in dialysis units included transmission from patients to staff and staff to patients. Staff members with the hepatitis C virus are at a much lower risk of infection than those with the hepatitis B virus. Hepatitis B vaccination of dialysis unit staff has been shown to be effective in reducing hepatitis B infection among these staff. Staff who are in contact with clinical equipment that may be infected

with the hepatitis B virus should also have HBV immunization (e.g. dialysis technicians) (Garthwaite *et al.*, 2019).

2.5.8. Management of a new case of Hepatitis B virus infection within the Hemodialysis unit

The patient should be informed when a new case of viral hepatitis is identified in the HD unit. In the medical record of the newly infected patient, the new infection should be registered, and local public health agencies should be informed of the infection. For high-risk exposure to hepatitis B virus, HBsAg should be tested every two weeks for 3 months, even if the exposed patient is considered impervious. After exposure to HCV, recommendations range from screening every two weeks for three months to every month to three months for six months (Nguyen *et al.*, 2019; Alavian *et al.*, 2008).

Whenever a previously unidentified case of HBV infection is identified, units should carry out enhanced HBV surveillance on all patients who are not adequately immune to HBV (anti-HBs titre >100mIU/mL within the last six months) and who have had a dialysis session in that unit since the index patient's last negative test (Fabrizi *et al.*, 2015; Strader *et al.*, 2004). Hepatitis B immunoglobulin (HBIG) should be considered for previous non-responders to the hepatitis B vaccine (anti-HBs <10mIU/ml) who may have been exposed in the previous 7 days (Lanini *et al.*, 2009; Liver, 2018).

When a hemodialysis patient develops a new BBV infection, expert virological advice should be obtained to coordinate enhanced surveillance of at-risk dialysis patients and carers and to arrange treatment for affected individuals. An 'outbreak group' should be formed, which should include representatives from the infection prevention committee and expert virologists, in addition to staff from the hemodialysis service. This group will coordinate the response. A clearly documented enhanced screening

process for contacts with identified staff responsibilities and regular review should be established (Liu and Chen, 2006; Couroucé *et al.*, 2000).

In addition, when there is a new case of a BBV infection within a hemodialysis unit, there should be a review of adherence to infection control procedures related to the management of BBV. There should be a review of cleaning and disinfection procedures (Rahnavardi *et al*., 2008; Minuk *et al.*, 2004).

2.6. Theoretical background

Depending on the concepts and data we will study and what has been mentioned in advance, the theory of Dorothy E. Johnson will be used as a Behavioral System Model, which I believe will be appropriate according to my study.

2.6.1. Introducing the Theorist

The "grand theorists" mentioned are all different from one another. Nevertheless, most of them agree to attach great importance to the idea of frameworks that mean and have significance for phenomena of interest to nursing. Dorothy Johnson’s first publications concerned with what knowledge base nurses required for nursing care. Throughout her career, Johnson stressed that nursing had a unique independent contribution to health care that was distinct from "delegated care. She was one of the first "grand theorists "to reveal her views as a conceptual model at Vanderbilt University in 1968. Johnson's model was the first to give a guide to understanding and an action guide. These two ideas about understanding the first seen as a process within a holistic system of behavior with a complex framework, and the second as an active process of convergence and response, are central elements in the work of other theorists who have

followed their lead and developed conceptual models of nursing practice (Alligood, 2017).

2.6.2. Major Concepts of the Model

2.6.2. a. Person

Johnson conceptualized a nursing client as a behavioral system. The behavioral system is orderly, repetitive, and organized with interrelated and interdependent biological and behavioral subsystems. The client is seen as a collection of behavioral subsystems that interrelate to form the behavioral system. The system may be defined as “those complex, overt actions or responses to a variety of stimuli present in the surrounding environment that are purposeful and functional” (Smith, 2019).

Johnson portrayed the nursing client as a behavioral system. The behavioral system is structured, repetitive, and structured with interlocking and interconnected biological and behavioral subsystems. The client is seen as a set of behavioral subsystems that are intertwined to form a behavioral system. The system can be defined as "complex responses to different stimuli found in the surrounding environment that are objective and functional (Younas and Quennell, 2019).

2.6.2. b. Subsystems

Subsystems are called behavioral system parts. It performs specialized functions or tasks necessary to maintain the integrity of the entire behavioral system and to manage its relationship with the environment. Each of these subsystems has a set of behavioral responses that are developed and modified through motivation, experience, and teaching (Meleis, 2011).

2.6.2. c. Environment

The term environment in systems theory is defined as a group of all objects that will affect a change in system attributes as well as those objects whose attributes are changed by system behavior. Johnson mentioned the external and internal environment of the system. It also refers to the interaction between a person and their surroundings, as well as objects, events, and situations in their surroundings (Alligood, 2017).

2.6.2. d. Health

Johnson viewed health as an efficient and effective performance of the system, balance, and stability in the behavioral system. The balance and stability of the behavioral system are reflected in observed behavior that is objective, orderly, and predictable. This behavior is maintained when it is efficient and effective in managing a person's relationship with the environment. Behavior changes when efficiency and effectiveness are not clear or when a more optimal level of performance is perceived (Meleis, 2011).

2.6.2. e. Nursing and Nursing Therapeutics

Nursing is "a complimentary service to medical services and other health professions, but it makes a significant contribution to people's health and well-being." Nursing was distinguished from medicine by pointing out that nursing viewed the patient as a behavioral system, while medicine viewed the patient as a biological system. In her view, the specific goal of nursing work is to "restore, maintain or achieve the balance of the behavioral system and stabilize it at the highest possible level for the individual". This goal can be extended to help a person achieve optimal balance and performance when possible and required (Smith, 2019).

2.6.2. f. Behavioral Subsystem

Social inclusion, intimacy, and the formation and attachment of a strong social bond.

- Dependency subsystem
- Ingestive subsystem
- Eliminative subsystem
- Sexual subsystem
- An aggressive subsystem
- The achievement subsystem

Johnson's theory defines health as a purposeful adaptive response to internal and external stimuli in order to maintain stability and comfort. The main goal of nursing is to foster equilibrium within the patient. The practice of nursing is concerned with the organized and integrated whole, but maintaining a balance in the behavior system when illness occurs is the major focus of the career (Smith, 2019).

Johnson's behavioral system theory is a model of care that focuses on human needs, human behavior, and using nursing to promote balance and decrease stress. The behavioral model has several applications in the nursing realm, including education, administration, clinical, and research. Despite the fact that Johnson's theory does not include clearly identified propositions, due to its high level of abstraction, the theory has been unitized in nursing education curriculums. According to Johnson, she hoped to develop a nursing curriculum that focused on nursing and was not solely derived from other disciplines. She believed that nursing was a discrete science and her beliefs have held true (Oyedele *et al*., 2010).

Johnson's theory and ideas have helped change the focus of nursing graduate programs from teaching and administration to clinical nurse

specialists and nurse practitioner programs. Programs such as these have helped to distinguish nursing and promote professionalism (Glenister, 2011).

Johnson's theory can be applied to administrative nursing as well. The behavioral model has been used to structure the administration departments of clinical agencies. A review of the literature clearly suggests that Johnson's model can be applied in the clinical setting. The Behavioral Model has been used to develop nursing interventions for patients in the hospital setting. Johnson made a revolutionary change in the way nursing was viewed when she proclaimed that nursing was different from medicine. She shifted the purpose of nursing care and her work continues to hold true in clinical settings throughout the world. Johnson's model has been implemented into patient care practices. Johnson's model provides a systematic approach to nursing assessments and a method to guide patient care (Smith, 2019).

2.7. Previous studies related.

The first study by (Shlash et al., 2020) aims to evaluate nurses' performance concerning infection control practices and to find out the relationship between nurses' performance and their demographic characteristics. Also, to find out the relationship between nurses' performance and patient data. A descriptive design was conducted at Hilla City Hospital for the period of September 2018 to March 2019. A checklist was used for data collection from those who work at the hemodialysis unit. Purposive sampling has been performed on thirty (30) nurses and thirty (30) patients in the dialysis unit. Direct observation for data collection. Nurses were observed three times while they were working in the dialysis unit. The data was analyzed through the application of descriptive and inferential data analysis. According to the study findings, (80%) used hand washing on occasion, (76.7%) used a uniform on occasion, and (66.7%) always used gloves, (53.3%) never wore a gown, and (86.7%) never wore a mask. A

majority of nurses (63.3%) have partially performed infection control measures. There is an insignificant association with nurses' demographic characteristics at p-value > 0.05.

Khan et al., (2017) conducted a descriptive cross-sectional study with the goal of determining the level of hepatitis B expertise and prevention practices among nurses at Dhaka Medical College Hospital. The study was carried out between January and June of 2015. The total sample size was 207, and data was collected using a purposive sampling technique through face-to-face interviews. The information was gathered using a structured questionnaire and analyzed using SPSS. The majority of the 207 respondents (54.1%) were between the ages of 18 and 30, with an average age of 33 + 0.2 years. Females outnumbered males by an 83.5 percent (16.4 percent) margin. The majority of them (81.2%). Approximately 83.1 percent of those polled were aware of alternative transmission routes. Nearly half (51.7%) were unaware that they were at risk of HBV infection, but more than half (56.5%) had received HBV vaccination. Hepatitis B had complications for the majority of them (85%). The average knowledge score was 8.28+2.9, with 80.7 percent having a high level of knowledge and just 19.3 percent having a low level of knowledge. The mean level of preventive practice was 4.78+1.3, with 87.4 percent having excellent preventive practice and 12.6 percent having bad preventive practice. The level of expertise of respondents was significantly associated with the mean practice of prevention (P0.001). Overall, experience and practice were found to be satisfactory in the study. Hepatitis B was a concern for the majority of the nursing staff. As a result, relevant educational and health promotion programs will help to further this knowledge and practice.

Another study by Joukar et al., (2017) aims to assess the knowledge of health services in relation to hepatitis B and hepatitis C infection. In a

multi-center cross-sectional study, all health workers from eight teaching hospitals were invited to participate in the study and fill out a self-managed questionnaire. A total of 1,008 qualified health workers responded to the study. A high percentage of study participants (55.4% and 52.9% of study participants) had unsatisfactory knowledge of HBV and HCV. The average level of HBV knowledge was much higher among the more educated staff (p 0.001) and individuals who had been vaccinated (P= 0.02).The majority of respondents correctly answered the questions about transmission of hepatitis B and HCV viruses (90% and 80%, respectively). There was a statistically significant difference in the degree of transmission range only between different hospitals ($p<0.05$). The highest grades were related to the surgical hospital. He concluded that although more than ninety percent of our participants were educated about hepatitis B and hepatitis C viruses, their knowledge about the nature of the disease, prevention, treatment, and vaccine availability was unsatisfactory. A continuous training program against viral infection is a necessity.

Al-Mawsheki et al., (2016) study "Nurses' knowledge and practice regarding care for patients during hemodialysis". A total of 94 out of 116 participants who were giving care to dialysis patients were in the study. A total of 39 (42%) received formal nursing training in hemodialysis and 71 (78%) respondents always counseled patients regarding fluid intake. A total of 37 (96%) trained nurses always counseled the importance of regular dialysis. Seventy-six (81.7%) respondents did counseling on vaccination against hepatitis B. counseling on vaccinations against influenza and pneumococcus was 47 (50%). When comparing educational status, respondents below bachelor level did more frequent counseling than those above (P=0.03). All the respondents knew the importance of hand washing and BP monitoring during hemodialysis. Ninety-one (96.7%) respondents knew how to deal with BP changes during hemodialysis. Seventy-three

(77.6%) respondents were very confident in managing complications. patients on continuous ambulatory peritoneal dialysis. during hemodialysis. Only 31 (33%) respondents knew how to deal with patients on continuous peritoneal dialysis. The study concluded that dialysis nurses have knowledge of basic procedures of hemodialysis, but there is a space for improvement in dealing with complications to provide quality service to hemodialysis patients.

The second study by (Mohammed and Hassan, 2014) aims to assess nurses' knowledge and practices about preventive measures for hepatitis (B and C) and to find out the relationship between the impact of the instructional program and nurses' demographic data. The researchers used a quasi-experimental design at Baghdad teaching hospital and Ghazi Al-Hariri for Specialist Surgeries hospital. During the period from June, 20th 2012 to June, 28th 2013, the sample was composed of 60 nurses who work in the surgical ward unit. Those nurses were divided equally into the study and the control groups. The researchers constructed an instructional program that consists of six sessions related to viral hepatitis, mode of transmission, and method of control during contact with patients and facilities. They exposed the study group to the conducted program and then measured the impact of the program on knowledge and practices of the study group by conducting an instrument which is composed of demographic data for nurses, assessment of the nurses' knowledge, and an observational checklist of nurses' practices for preventive measures of viral Hepatitis (BC) infection control, and differentiated from the control group. The researchers analyzed the data through the application of descriptive and inferential analysis. The study confirms that the instruction-oriented program on nurses' study group is significant and that there were statistical differences between the level of education and years of experience with knowledge and practices at $P \geq 0.05$. The study recommends the application of a national program of

immunization against viral hepatitis at all health centers, a continuous medical education program for all staff in the health centers, and continuous follow-up to apply the program of preventive measures for VHB, and VHC.

The objectives of the Bakey, (2014) study are to assess the practices of nurses throughout the treatment of dialysis patients and to determine the relationship between nurses' practices and demographic data. A descriptive study was conducted at Baghdad Teaching Hospitals, which started from December 25, 2011, to May 9, 2012. Nurses who worked in dialysis units were unlikely (30).The data was collected through the use of questionnaires created, consisting of two parts: (1) a demographic data model consisting of 10 items; and (2) the form of nurses' practices consisting of 25 items, direct interview, and nurse perception. The reliability of the questionnaire was determined by a pilot study, and the validity of the questionnaire by a team of nine experts. The data analysis was used for descriptive statistical analysis and inference statistical analysis procedures. The results of the study indicated that there is a deficiency in the practice of nurses that must be applied to the patient throughout the period of dialysis treatment, and no significant relationship was found between the practice of nurses and their sex, their level of education, and years of experience in dialysis units, while a significant relationship was found between the practice of nurses and their marital status. The study recommended that an academic nurse should be recruited to work in kidney units and that a booklet should be allocated and distributed to all nurses who work in dialysis units, including standard procedures that must be applied and followed to care for patients in dialysis units.

Study by Rinonce *et al*., (2013), "Hepatitis B and C virus infection among hemodialysis patients in Yogyakarta, Indonesia: Prevalence and molecular evidence for nosocomial transmission". In order to investigate

these issues and the possibility of nosocomial transmission, 161 hemodialysis patients and 35 staff members at one of the hemodialysis units were tested for serological and virological markers of both viruses. The HBV surface antigen (HBsAg) was detected in 18 patients (11.2%) and in two staff members (5.7%). Anti HCV was detected in 130 patients (80.7%) but not in any staff members. Occult HBV and HCV infections were detected in 21 (14.7%) and 4 (12.9%) patients, respectively. The overall prevalence rates of HBV and HCV infection among patients were 24.2% and 83.2%, respectively. HCV infection was independently associated with hemodialysis duration and the number of blood transfusions. Analysis revealed that 23 of 39 tested HBV strains (59%) were genotype B, 11 (28.2%) were genotype C, and 5 (12.8%) were genotype A. HCV genotype 1a was dominant (95%) among 100 tested HCV strains. Nosocomial transmission was suspected because the genotype distribution differed from that of the general population in Indonesia, and because the viral genomes of several strains were identical. These findings suggest that HBV and HCV infection is common among hemodialysis patients in Yogyakarta, and probably occurs through nosocomial infection. Implementation of strict infection control programs is necessary in hemodialysis units in Indonesia.

In Italy, a comprehensive survey of nurses was conducted by Bianco et al., (2013) in the Calabria region to obtain information on the level of knowledge, attitudes, and frequency of evidence-based practices that prevent the transmission of the hepatitis C virus in hospitals. All 37 hemodialysis units in the city were included in the study, and all nurses participated in the study and filled out a self-administered questionnaire. The results of the study show that 90% of the nurses working in the Human Development Unit participated in the study. The correct answers about the pattern of hepatitis C virus transmission ranged from 73.7% to 99.3% and the positive attitude was higher among the most knowledgeable nurses. Self-reporting of

appropriate hand-washing procedures was much more likely among nurses who were aware that transmission of blood-borne pathogens among health care workers might be prevented through the adoption of evidence-based practices and with proper knowledge of patterns of hepatitis C virus transmission. The study concluded that behavioral changes should aim to abandon outdated practices and adopt evidence-based practices. Initiatives focusing on empowering and promoting commitment to effective prevention practices among nurses at the university are urgently needed.

Athbi and Mohammed, (2010) study, aimed to determine the impact of an infection control education program on nurses' knowledge of dialysis units and to identify the relationship between the effects of improving nurses' luxury on demographics in dialysis units. The pre-trial study (pre-test design for one group) was conducted in dialysis units at Baghdad teaching hospitals, from December 1, 2009, to September 30, 2010. The program was adopted, and the questionnaire was built by the researchers to achieve the objectives of the study. A sample of fifteen nurses was selected from dialysis units, and the selection was based on study criteria and after taking their consent. The data was collected to measure the effectiveness of the program, using a questionnaire consisting of 50 items of multi-choice questions distributed in seven sections. The reliability of the device was tested through an experimental study from May 30, 2010, to June 20, 2010. and health through a committee of fifteen experts. Through the application of descriptive and inference statistical analysis procedures, the data was analyzed. The results of the study indicate that the education program has been found to be effective in improving the knowledge of participants. It was found that there was a significant relationship between the effect of improving nurse knowledge and years of experience in dialysis units, and that the decrease in the number of years of experience had more improved effects than the other groups. The study recommends additional studies on the application of

nursing education programs to the practice of infection control procedures in dialysis units.

A quasi-experimental study by Mohmmod (2007) was carried out at the hemodialysis units in teaching hospitals in Baghdad city, which included Al-Yarmouk teaching hospital, Al-Karama teaching hospital, surgical specialist, and Al-Kadhmiya teaching hospital. The aim of the study is to determine the effect of an education program on nurses' knowledge of who practice in hemodialysis units. The sample, comprised of thirty nurses, was selected purposively and divided equally into study and control groups. The data was collected through the use of the nurse's knowledge and observation checklist, which was developed for the purpose of the study. Content validity is used to determine the instrument, by a panel of experts. The reliability determined through the use of the Pearson correlation coefficient was (0.82) for nurses' knowledge and (0.84) for nurses' practices. Data is analyzed through the application of descriptive and inferential statistics. The study results show that the implementation of the educational program has a high effect on significant differences between the study and control groups. The study concludes that the education program could be considered as an effective way to improve nurses' knowledge and skills. The study recommended that special and long training programs for nurses in the hemodialysis units and nursing staff should be increased.

Another study by Nihmatolla and Al-gersha, (2005), aims to assess the infection control process in hemodialysis units and to find out the relationship between nurses' practices and some of the demographic characteristics. A descriptive study was conducted at hemodialysis units in Hawler hospital and Azad hospital in Duhok Governorate, from January 15th, 2004 to the end of May. The data was collected through the use of questionnaires consisting of two parts: (1) a demographic data model

consisting of 10 items, and (2) the form of nurses' practices consisting of 25 items, through a direct corresponding technique and a perception of nurses. The reliability of the questionnaire was determined by an experimental study and the validity of the questionnaire by a team of nine experts. The data was not available in the country. The results of the study indicated that there is a deficiency in the exercise of nurses that should be applied to patients throughout the duration of kidney treatment. There is also no significant relationship between the practice of nurses, their gender, their level of education, and years of experience in dialysis units, while there is a great relationship between nurses' practice and their marital status. The study recommended the need to employ an academic nurse in kidney units, and a booklet should be distributed to all nurses who work in dialysis units, including standard procedures that must be applied and followed to care for patients in dialysis units.

Chapter Three

Methodology

Chapter Three
Methodology

This chapter explains the research design that was used in the study. It also includes the administrative arrangements, setting of the study, sample of the study, criteria of the sample, instruments of the study, validity of the questionnaire, conducting a pilot study, reliability of instruments, data collection, and data analysis.

3.1 .Design of the Study:

Descriptive cross-sectional study design was carried out to accomplish the stated objectives. During the period from 1st October 2019 to 27th June 2021.

3.2 .Administrative Arrangements:

The first approval was obtained from the University of Babylon, Nursing College/ department of graduate studies to conduct this study after clarifying the objectives of the study and its importance, as well as formal approval of the questionnaire obtained from the ethical committee of the department of college of nursing/department of graduate studies on September 24th, 2020.

Formal permission has been obtained from Al-Basra Health Directorate/The Centre for Training and Development Staff on October 13th, 2020, Maysan Health Directorate/The Centre for Training and Development Staff on October 12th, 2020, Dhi-Qar Health Directorate/The Centre for Training and Development Staff on November 8th, 2020 and AI-Muthanna Health Directorate/The Centre for Training and Development Staff on October 18th, 2020 (appendix A, B, C, and D). The written agreement was also obtained from the nurses after the researcher explained

the purpose of the study to them; sought consent; and offered respect to participants' confidentiality to answer the questionnaire.

3.3 .Ethical Consideration:

Ethical considerations are important for protecting a person's rights related to data collected, confidentiality, and promoting professional study conduct. The following ethical issues are dependent:

- The agreement to participate is voluntary.
- Respect the participants' feelings by encouraging, honest, and open communication and listening effectively to understand the nurses' responses to health issues.
- The questions addressed to nurses are formulated in a way that is easily understood according to their educational level and cultural background, as well as language proficiency.

All participants were informed fully about the current study and its aims, and then voluntary written consent was obtained from the participants in order to participate in the study. Besides, it has been taken into account the confidentiality of information obtained from nurses. In addition, ethical approval was obtained from the ethical committee of research at the Faculty of Nursing/University of Babylon regarding confidentiality and anonymity of participants.

3.4. Setting of the Study :

The study was conducted at hemodialysis units in the southern provinces of Iraq at the following hospitals:

1. AL-Basrah teaching hospital (Basrah city).
2. AL-Sader teaching hospital ((Basrah city).
3. AL-Sader teaching hospital (Maysan city).

4. Emam-Hussein teaching hospital (Dhi-Qar city).
5. AL-Hussein teaching hospital (AL-Muthanna city).

The reason for choosing those units is that they are the only units in the mentioned provinces.

3.5 .The Sample of the Study:

A non-probability (purposive) sample of 96 nurses (males and females) working at hemodialysis units in four provinces (Table 3.1). The nurses were assigned to the study according to the following criteria:

1. Those who were working at the hemodialysis units were willing to participate.

2. Those who should have one year of employment and more.

Table 3.1. Distribution of sample

	Setting	No	%
1	Al-Basrah teaching hospital (Basrah city)	28	29.16
2	AL-Sader teaching hospital(Maysan city)	22	22.92
3	Emam-Hussein teaching hospital (Dhi-Qar city)	35	36.46
4	AL-Hussein teaching hospital (AL-Muthanna city).	11	11.46
	Total	106	100%

3.6 .Study Instrument

A structured questionnaire is constructed through extensive review of relevant literature and related research and studies, as well as depending on Garthwaite *et al.*, (2019), clinical practice guideline management of blood borne viruses within the hemodialysis units.

A face-to-face interview technique is used to collect nurses' knowledge regarding preventive measures and precautions regarding hepatitis B and C in hemodialysis unit patients. The questionnaire was divided into two main parts. Part one contained sociodemographic information. Part two was divided into five domains, and consists of 42 items as the following:

Part 1: Demographic Data :

The demographic data consists of 14 items, which are age, gender, level of education, years of experience, training sessions, number of nurses in the hemodialysis unit, number of shifts per day, number of patients per shift, number of nurses per shift, the time between shifts per minute, number of hemodialysis patients, number of patients with hepatitis B, number of patients with hepatitis C, number of patients with co-infection.

Part 2: nurses knowledge regarding preventive measures and precautions of hepatitis B and C in hemodialysis units.

The second part of the questionnaire was comprised of 42 items that concerned nurses' knowledge relative to preventive measures and precautions for hepatitis B and C in hemodialysis units, and this part was divided into five domains as following:

First domain: Universal precautions

This domain includes (12) items that present nurses' knowledge regarding universal precautions at hemodialysis units.

Second domain: Dialysis machine equipment

This domain includes (6) items that present nurses' knowledge regarding the dialysis machine equipment's.

Third domain: Surveillance of patients in hemodialysis units

This domain includes (10) items that present nurses' knowledge regarding the surveillance of patients in hemodialysis units.

Forth domain: Separation of patients in hemodialysis units

This domain includes (4) items that present nurses' knowledge regarding the separation of patients in hemodialysis units.

Fifth domain: Immunizations and medications in hemodialysis units

This domain includes (10) items that present nurses' knowledge regarding immunizations and medications in hemodialysis units.

The overall numbers of items were rated on a three-level Likert scale; yes, uncertain, and no and scored as 3, 2, and 1, respectively (Appendix E).

3.7. Validity of the instrument

Validity is the degree obtained by the instrument and represents its measurement (Polit & Beck, 2014).

The validity of the instrument was determined by a panel of experts who have more than ten years of experience in their field exploring the lucidity, relevance, and adequacy of the questionnaire to accomplish the goals of the present study (Appendix F).

A questionnaire was designed and distributed to the thirteen experts. They were (3) faculty members from the College of Nursing/ University of Baghdad; (3) faculty members from the College of Nursing and College of Medicine/University of Al-Basra; (1) faculty member from the College of Nursing/University of Al-Diwaniyah; (3) faculty members from the College of Nursing/University of Babylon; (1) faculty member from the College of Nursing/University of Kirkuk; (1) faculty member from the College of Nursing/ University of Khufa; and (1) faculty member from the College of Nursing/University of Karbala. The majority of experts approved that the questionnaire was well developed and constructed in order to assess the nurse's knowledge. Furthermore, the comments and suggestions of most experts were taken into account. The final copy of the questionnaire was developed and prepared to accomplish the study.

3 .8. Pilot Study

A purposive sample of ten nurses was selected randomly among those who worked at the hemodialysis unit in AL-Sader Teaching Hospital (Basrah city) and carried out on October 15th, 2020. The participants were male and female nurses, to assess levels of knowledge about preventive measures and precautions regarding hepatitis B and C in hemodialysis units. The sample of the pilot study was excluded from the main study sample.

3.8. A. The purpose of the Pilot Study is to:

1-Determine the stability and credibility of the study tool.

2-Clarity and its efficiency and standard time required to collect data for each character which can be estimated during the interview.

3-Determine the difficulties and limitations which occur during data collection.

4-Examine the consistency and reliability of the questionnaire.

3.8. B. The Results of the Pilot Study:

The results of a pilot study declared that the questionnaires were clear and understandable by the nurses after they distributed them to each nurse's staff. The average time that was taken by the nurses' participants to fill out the questionnaire was between (20-25) minutes.

3.9. Reliability of the study instruments:

The alpha coefficient (or Alpha Kronbach) is the most widely used tool for determining the internal consistency and homogeneity of a variable composed of many subparts. The Alpha coefficient is similar to other reliability coefficients in that it has a standard range of values between (-1.00) through (.00) to (+ 1.00), with higher values suggesting greater internal consistency. Since it calculates the split-half association with all conceivable ways to divide the calculation into two parts, the alpha coefficient is stronger than the split-half method (Polit & Beck, 2014).

In addition to that, the test was separately performed for all domains (Table 3.2). The result of the Cronbach's Alpha test showed acceptable and high reliability and that, depending on the value of the Cronbach's Alpha, which is (0.70), the results were (0.82) for universal precautions domain, (0.75) for dialysis machine equipment domain, (0.93) for surveillance of patients in hemodialysis units domain, (0.88) for the separation of patients domain, (0.86) for immunizations and medications domain, and for all items is (0.96) The reliability was determined through the use of the SPSS Program version 22/Reliability Analysis.

Table 3.2. Reliability of the study instrument :

Domains	Number of questions	Cronbach's Alpha value	Accepted value	Assessment
Universal precautions	**12**	**0.82**	**0.70**	**pass**
Dialysis machine equipment	**6**	**0.75**	**0.70**	**pass**
Surveillance of patients in hemodialysis unit	**11**	**0.93**	**0.70**	**pass**
Separation of patients	**4**	**0.88**	**0.70**	**pass**
Immunizations and medications	**8**	**0.86**	**0.70**	**pass**
Total	**42**	**0.96**	**0.70**	

Normally, the reliability coefficient ranges from (-1.00) to (.00) to (+ 1.00), with reliability coefficients above (0.70) considered satisfactory (Brouwaers *et al*., 2015).

3.10. Data Collection:

The researcher met all the nursing staff of hemodialysis units that were selected to collect data to get a written agreement. Then, the nurses were told about the objectives of the study and the right way to fill in the questionnaire fields and answer the questions, by using the Arabic version of the questionnaire. Through the use of a well-constructed questionnaire, the data was collected by the method of direct interview technique. The participant needed approximately (20-30) minutes to complete the

questionnaire and answer all the questions. The data collection period continued from 15th September 2020 to 30th November 2020.

3.11. Rating and scoring

The items of the study questionnaire have been rated and scored according to the following 1 for no, 2 for not sure, and 3 for yes.

3.12. The Statistical Analysis:

Data was analyzed using the Statistical Package for Social Science (SPSS), version 22 for Windows.

The questions that were used in collecting data were checked out to avoid any mistakes or errors, and scrutinized. Then they were transferred and computerized and coded by their numbers in Microsoft Excel 2016. The data of the 96 nurses was entered and analyzed by means of the statistical package for social sciences (SPSS), 24.0, which was released in March 2016. Percentages, mean, in addition to frequencies, and standard deviation were used to attain descriptive statistics.

For the assessment of the relationship between variables, the Chi Squared test and Analysis of variance (ANOVA) were used, and the probability value (P) was calculated to assess the significance of the relationships. The level of significance was set at ≤ 0.05 as significant. In conclusion, the results and findings of the existing study were presented in tables with a clarifying section for each table using the Microsoft Office Word program software for Windows, version 2016.

3.12.1. The descriptive Data Analysis:

3.12.1. a. Frequency (F):

Frequency distributions are one of the simplest ways to provide results. Calculating the frequency of values or grades expressed in the data yields frequencies. All data levels can be reported using frequency distributions (nominal, orderly, interval, and ratio). All values or grades are listed in a frequency distribution, and the number of times each one occurs is registered. Values may be described in either top-to-bottom or bottom-to-top order. The frequency of an event in statistics refers to the number of times an event occurs in a given experiment or sample. It was used to describe the distribution of demographic variables in a sample (LoBiondo *et al*., 2014).

3.12.1. b. Percentage (%):

The percentage is a statistic that represents the subgroup-total group ratio, which is expressed as a percentage of 0 to 100. The percentage is the number of parts per 100 that represent a certain part of the output that is obtained by multiplying the number percent (one part in a hundred). It has been used for describing the distribution of sample demographic variables (Merriam and Webster, 2016). And is calculated consistent with this formula: Percentages $\% = \frac{f}{n} * 100$

3.12.1. c. Mean of Score (M.S):

The arithmetic mean is the sum of the individual values in a data set divided by the number of values in the data set. It was used for calculating and determining the level of knowledge (Chernick & Friis, 2003). And was calculated according to the following formula:

$$M.S = \frac{\sum \text{ri} = 1\text{Fi x Si}}{\sum \text{ri} = 1\text{Fi}} x100$$

(Randolph & Myers, 2013).

3.12.1. d. Standard Deviation:

The consequence of multiplying a number by a percent (a calculation of frequency distribution dispersion that is the square root of the arithmetic mean of the squares of the variance of each class frequency from the arithmetic mean of the frequency). Alternatively, a parameter that shows how a probability function or a probability density function is based on its mean and is capable of the square root of the variance from the mean square (Rentala, 2018).

$$S = \sqrt{\frac{\Sigma(X - \overline{X})^2}{N}}$$

where S = the standard deviation of a sample,
Σ means "sum of,"
X = each value in the data set,
$\overline{X}$ = mean of all values in the data set,
N = number of values in the data set.

3.12.2. Inferential statistical procedure

Parametric and non-parametric statistical tests are two types of inferential statistical tests. Parametric tests involve interval or ratio data, and they presume that the data sample was drawn from evenly distributed groups with equal differences. Non-parametric tests can be used for nominal and ordinal data and do not depend on population distribution assumptions(Barton & Peat, 2014). It included:

3.12.2. a. Chi-square test:

The chi-square test is a nonparametric inferential technique appropriate for comparing sets of data that are in the form of frequencies or percentages (nominal data). The chi-square statistic (x2) is probably the

most commonly used statistic with nominal data. Chi-square is one of the important nonparametric tests that are used to compare more than two variables for randomly selected data. The expected frequencies are calculated based on the conditions of the null hypothesis. The rejection of the null hypothesis is based on the difference between actual value and expected value (Barton & Peat, 2014) . It is calculated as:

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

O = the frequencies observed
E = the frequencies expected
$\sum$ = the 'sum of'

3.12.2. b. Analysis of Variance (ANOVA):

ANOVAs are useful for determining the statistical significance of three or more meanings (groups or variables). They are a collection of statistical methods that are used to assess the differences in group meanings and the processes that go with them (such as "variation" among and between groups). It's similar to multiple two-sample t-tests in concept, but it's more conservative (resulting in fewer type I errors) and hence better suited to a wide range of real-world applications (; Grove & Gray, 2018; Gray *et al*., 2016). It is calculated as (table 3.3):

Table(3.3) One-Way ANOVA				
Source	**Degrees of Freedom DF**	**Sum of Squares SS**	**Mean Square(MS)**	**F-Stat**
Between Groups	**k – 1**	**SS_B**	**$MS_B = SS_B / (k - 1)$**	**$F = MS_B / MS_W$**
Within Groups	**N – k**	**SS_W**	**$MS_W = SS_W / (N - k)$**	
Total	**N – 1**	**$SS_T = SS_B + SS_W$**		

MS: Mean Squares, SS: sum of square, DF: degree of freedom

F = (MS between)/ (MS within)
MS between = (SS between)/ (K-1)
MS within = (SS within)/ (N-K) (Randolph & Myers, 2013).

3.12. 2. C. A Scheffe test

The Scheffe test is a statistical test that is a post-hoc test used in statistical analysis. It was named after the American statistician Henry Scheffe. The Scheffe test is used to make unplanned comparisons, rather than pre-planned comparisons, among group means in an analysis of variance (ANOVA) experiment. An unplanned comparison is a comparison made within a data set after an ANOVA test has been run, so the parameters of the comparison are not built into the ANOVA experiment. The Scheffe test can be used to determine whether individual means differ, or whether the average of one group of means differs from the average of another group of means (Aslam and AL Bassam, 2020).

Chapter Four

Results

Chapter Four

Result of the Study

This chapter presents the results of the study as follows :

Table 4.1. Socio-demographic characteristics and distribution of the study sample. (N = 96)

Data	Rating And Intervals	Frequency	Percent
Provinces units	Basrah	28	29.1 %
	Maysan	22	22.9 %
	Dhi-Qar	35	36.5 %
	Muthanna	11	11.5 %
	Total	96	100%
Gender	Male	64	66.7 %
	Female	32	33.3%
	Total	96	100%
Age	21-25	22	22.9 %
	26-30	31	32.3 %
	31-35	14	14.6 %
	36-40	15	15.6 %
	41 & more	14	14.6%
	Total	96	100%
Level of education	Secondary school	27	28.2%
	Institute	49	51.0 %
	University	20	20.8 %
	Total	96	100 %
Years of experiences	1 – 5	40	41.7%
	6 – 10	31	32.3%
	11 – 15	25	26.0%
	Total	96	100 %
Training session	Yes	57	59.37%
	No	39	40.63%
	Total	96	100 %

The table explains the data of a total of 96 nurses who participated in the study. Most of them (36.5%) were from Dhi-Qar province. The males

were (66.7%) (26-30) years old. (51.0%) were institute graduates, (41.7%) with 1-5 years of experience, and (59.37%) were enrolled in the training session.

Table 4.2. Socio-demographic characteristics and distribution of the hemodialysis unit sample at Basrah teaching hospital in Basrah province. (N = 28)

Demographic Data	Rating And Intervals	Frequency	Percent
Gender	Male	21	75%
	Female	7	25%
	Total	28	100%
Age	21-25	6	21.5%
	26-30	10	35.7%
	31-35	3	10.7%
	36-40	7	25.0%
	41 & more	2	7.10%
	Total	28	100%
Level of education	Secondary school	13	46.4%
	Institute	15	53.6%
	University	0	0
	Total	28	100%
Years of experiences	1 – 5	11	39.3%
	6 – 10	9	32.1%
	11 – 15	8	28.6%
	Total	28	100%
Training session	Yes	18	64.28%
	No	10	35.72%
	Total	28	100%

The findings of this table show the demographic data of 28 nurses who participated in the study at Basrah teaching hospital, where most of them (75%) were male. The high percentage was (75%) single, (26-30) years old. The majority of participants (53.6%) were institute graduates (67.7%), (41.7) with 1-5 years of experience and (64.28%) enrolled in training sessions.

Table 4.3. Socio-demographic characteristics and distribution of the hemodialysis unit sample at AL-Sader teaching hospital in Maysan province. (N = 22)

Demographic Data	Rating And Intervals	Frequency	Percent
Gender	Male	19	86.4%
	Female	3	13.6%
	Total	22	100%
Age	21-25	6	27.3%
	26-30	7	31.8%
	31-35	4	18.2%
	36-40	3	13.6%
	41 & more	2	9.1%
	Total	22	100%
Level of education	Secondary school	3	13.6%
	Institute	19	86.4%
	University	0	0
	Total	22	100%
Years of experiences	1 – 5	10	45.5%
	6 – 10	7	31.8%
	11 – 15	5	22.7%
	Total	22	100%
Training session	Yes	5	22.73%
	No	17	77.27%
	Total	22	100%

This table presented the demographic data of 22 nurses who participated in the study at a teaching hospital in Maysan province. Most of them (91%) were males, (26-30) years old. The majority of participants (86.4%) were institute graduates, (45.5%) with 1-5 years of experience, and (77.27%) were enrolled in training sessions.

Table 4.4. Socio-demographic characteristics and distribution of the hemodialysis unit sample at Emam Hussein Teaching Hospital in Dhi-Qar province. (N = 35)

Demographic Data	Rating And Intervals	Frequency	percentage
Gender	Male	19	54.3%
	Female	16	45.7%
	Total	35	100%
Age	21-25	9	25.7%
	26-30	12	34.3%
	31-35	5	14.3%
	36-40	3	8.6%
	41 & more	6	17.1%
	Total	35	100%
Level of education	Secondary school	8	22.9%
	Institute	12	34.2%
	University	15	42.9%
	total	35	100%
Years of experiences	1 – 5	18	51.4%
	6 – 10	11	31.4%
	11 – 15	6	17.2%
	total	35	100%
Training session	Yes	25	74.67%
	No	9	25.33%
	Total	35	100%

This table reveals the demographic data of 35 nurses who participated in the study at the teaching hospital in Dhi-Qar province. Most of them (54.3%) were male, (26-30) years old. The majority of participants (42.9%) were university graduates, (51.4%) with 1-5 years of experience, and (74.67% were enrolled in training sessions.

Table 4.5. Socio-demographic characteristics and distribution of the hemodialysis unit sample at AL-Hussein Teaching Hospital in Muthanna province. (N = 11)

Demographic Data	Rating And Intervals	Frequency	Percentage
Gender	Male	5	45.5%
	Female	6	54.5%
	Total	11	100%
Age	21-25	1	9.0%
	26-30	2	18.2%
	31-35	2	18.2%
	36-40	2	18.2%
	41 & more	4	36.4%
	Total	11	100%
Level of education	Secondary school	3	27.3%
	Institute	3	27.3%
	University	5	45.4%
	total	11	100%
Years of experiences	1 – 5	1	9.1%
	6 – 10	4	36.4%
	11 – 15	6	54.5%
	total	11	100%
Training session	yes	6	54.54%
	No	5	45.55%
	total	11	100%

The findings in this table show the demographic data of 11 nurses who participated in the study at AL-Muthanna province AL teaching hospital. Most of them (54.5%) were females, (41 & more) years old. The majority of participants (45.5%) were university graduates, (54.5%) with 11-15 years of experience, and (54.54%) were enrolled in training sessions.

Table 4.6. Distribution of nurses, number of nurses per shift, number of shifts, patients per shift, and time between shifts at four hemodialysis units.

Hemodialysis units	Number of nurses in unit	Number of nurses per shift	Number of shifts	Number of patients per shift	Time between shifts
Basrah	28	6	3	35	30 min
Maysan	22	5	3	14	45 min
Dhi-Qar	35	7	4	18	60 min
Muthanna	11	4	2	8	120 min

This table shows the highest number of nurses in Dhi Qar province (35) and the lowest number in Muthanna (11), and also shows the highest number of shifts in Dhi Qar (4) and the lowest number in Muthanna (2), the highest number of patients per shift in Basrah (35) and the lowest number in Muthanna (8), and finally, the table shows the time between shifts in Muthanna is the highest (120) minutes, while in Basra it is the lowest (35) minutes.

Table 4.7. Percentage of viral hepatitis at hemodialysis units in four provinces.

Hemodialysis units	HB	HC	Co-infection	Total patients with hepatitis	Total patients	% of patients with hepatitis
Basrah	8	78	19	105	443	23.70 %
Maysan	5	13	1	19	143	13.28%
Dhi-Qar	3	24	0	27	250	10.8 %
Muthanna	2	2	1	5	56	8.92%

The findings of this table show the highest percentage of viral hepatitis (B & C) in the Basrah hemodialysis unit (23.70%) and the lowest percentage in the Muthanna hemodialysis unit (8.92%).

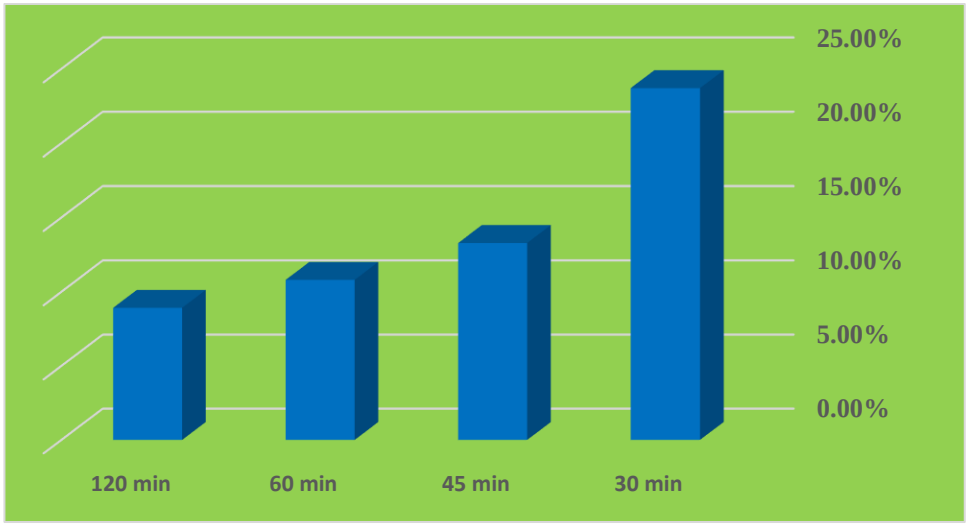

Figure 4.1. Association between time between shifts and the percentage of hepatitis infected.

Table 4.8. The mean score of all the items of nurses' knowledge regarding hepatitis B and C preventive measures and precautions in four provinces.

Items	M	St. D	Ass.
1.Universal precautions			
1. Hand washing after interaction with patients, blood, fluids, or potential blood-contaminated objects or materials.	3.00	.000	G
2. When dealing with a patient or contacting the dialysis machine, sterile gloves must be worn.	3.00	.000	G
3. Change gloves and handwashing between patients on a regular basis.	3.00	.000	G
4. Disposable plastic aprons or waterproof robes should really be utilized when splashes involving blood or other fluids are a possibility.	3.00	.000	G
5. When blood, secretions, or infected tissue are likely to spray on the face, use eye protection.	2.86	.344	G
6. Any cuts or abrasions should be covered with plaster.	2.64	.484	G

7. Sharps should be disposed of immediately and safely in puncture-proof sharp containers.	2.60	.492	G
8. Sharp containers must be filled before disposal.	1.52	.580	P
9. The needle cover must be returned before throwing in sharp containers.	1.56	.595	P
10. Taking unwanted drugs and supplies to a dialysis center for disposal.	2.02	.615	M
11. Clean resources must be kept separate from contaminating tools and equipment.	2.22	.416	M
12. Surfaces at the dialysis unit are cleaned and disinfected.	2.99	.102	G
2. Dialysis machine equipment			
13. Checking the dialysis machine for fluid contamination, including the transducer protector.	1.78	.619	M
14. Dedicated machines are required for patients infected with HCV, provided cleaning and disinfection procedures are strictly adhered to between patients.	1.73	.672	M
15. External protection on blood circulation pressure lines must be checked by healthcare providers.	1.84	.509	M
16. Cleaning the dialysis device should only be done at the start of each day.	1.62	.743	P
17. Patients who are known to be infected with the HB virus might use separate washing machines.	2.15	.383	M
18. HBV washing machines can be used again for uninfected patients after being decontaminated.	1.65	.725	P
3. Surveillance of patients in hemodialysis unit			
19. Dialyzing patients with HBV infection should not be done at the same time as dialyzing patients without HBV infection.	2.54	.501	G
20. All patients who start dialysis or return to dialysis after treatment in another way should be negatively known to HBV plasma surface antigen before dialysis in the main dialysis unit.	2.08	.592	M
21. All patients beginning hemodialysis or returning to hemodialysis after another kind of treatment should be tested for HCV.	2.56	.499	G
22. Immunity can be screened for patients who do not have specific risk factors for hepatitis C virus.	2.05	.569	M

23. Patients who need dialysis before the HBsAg test results are available should always be dialyzed in the central dialysis unit.	1.89	.578	M
24. 1. Whenever a new individual with HBV infection is found, the individual is sent to an HBV expert for further evaluation of antiviral medication.	2.32	.703	M
25. For all patients, units may want to screen for HBsAg every 6 months.	1.80	.763	M
26. Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months.	1.76	.594	M
27. Health measures should be observed directly or through contaminated surfaces or materials to effectively avoid the spread of contaminated blood among patients.	2.44	.751	G
28. Whenever a new episode of BBV contamination in a dialysis unit is discovered, cleaning and disinfection protocols should not be reviewed.	1.63	.620	P
4. Separation of patients			
29. Patients who refuse BBV screening must have dialysis in a separate area unless they have been confirmed to have been HBV immune in the previous 6 months.	2.05	.622	M
30. Dialysis for HBV-infected patients must take place in a separate space from the general dialysis unit.	2.49	.503	G
31. Patients with HCV should be dialyzed in a separate room to ensure infection control and that universal measures are followed.	1.57	.661	P
32. Staff members are at a substantially higher risk of contracting HCV infection than they are of contracting HBV infection.	1.70	.783	M
5. Immunizations and medications			
33. Patients who are HBV infective can't be dialyzed by workers who are not immune to HBV or infected with the virus.	1.75	.523	M
34. All dialysis patients should be tested for current or previous Hepatitis B infection and, if necessary, administered the HBV vaccine.	2.93	.261	G
35. Low dosages, repeated doses, or both are used in the primary HBV vaccination programs.	1.59	.608	P

36. The immunizations are given intramuscularly (deltoid muscle) as per the manufacturer's instructions.	1.91	.872	M
37. Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.	1.90	.703	M
38. Patients who are nonresponders to vaccines should be tested at least every 6 months.	1.91	.727	M
39. HBV vaccination should be given to all members who have clinical interaction with clients.	2.99	.102	G
40. After a single use, vials must be disposed of, and multi-use vials must be prevented.	2.48	.562	G
41. If a single drug vial is used to treat many patients, it is divided into numerous dosages and supplied from a central location.	2.39	.716	G
42. Intravenous medicine vials that are labeled for one use could be punctured several times.	1.85	.615	M

N (96), mean of score (3), cut off point (0.66), poor, (mean of score 1-1.66), moderate (mean of score 1.67-2.33), good (mean of score more than 2.33).

The table above revealed the mean score for nurses' knowledge of all items of preventive measures and precautions for viral hepatitis B and C for all items in the hemodialysis unit for the whole study sample in four provinces.

Table: 4.9. Overall assessment of nurses' knowledge of all domains of viral hepatitis B and C preventive measures and precautions in four provinces.

	Domains	M.S	Ass.
1	Universal precautions	2.53	G
2	Dialysis machine equipment	1.79	M
3	Surveillance of patients in hemodialysis unit	2.10	M
4	Separation of patients	1.95	M
5	Immunizations and medications	2.17	M

This table demonstrated that the universal precautions domain has a high mean score (2.53) while the dialysis machine equipment domain has the lowest mean score (1.79).

Table 4.10. Mean score of nurses' knowledge regarding all domains of preventive measures and precautions for viral hepatitis B and C in four provinces in Hemodialysis Units.

Level of knowledge	F	%	M.S	S.D	Ass
Poor	7	16.66	2.25	.54290	Moderate
Moderate	19	45			
Good	16	38			
total	42	100			

F: frequency, %: percentage, MS: mean score, St.d: standard deviation, Ass: assessment

The table above shows the mean score of the nurses' knowledge of preventive measures and precautions for viral hepatitis B and C in four provinces is moderate.

Tale 4.11. The mean score of all the items of nurses' knowledge regarding hepatitis B and C preventive measures and precautions in Hemodialysis Units in Basrah city.

Items	M	St. D	Ass.
1.Universal precautions			
1. Hand washing after interaction with a patients, blood, fluids, or potential blood-contaminated objects or materials.	3.00	.000	G
2. When dealing with a patient or contacting the dialysis machine, sterile gloves must be worn.	3.00	.000	G
3. Change gloves and handwashing between patients on a regular basis.	3.00	.000	G
4. Disposable plastic aprons or waterproof robes should really be utilized when splashes involving blood or other fluids are a possibility.	3.00	.000	G

5. When blood, secretions, or infected tissue are likely to spray on the face, use eye protection.	2.75	.441	G
6. Any cuts or abrasions should be covered with plaster.	2.29	.460	M
7. Sharps should be disposed of immediately and safely in puncture-proof sharp containers.	2.25	.441	M
8. Sharp containers must be filled before disposal*.	1.39	.497	P
9. The needle cover must be returned before throwing in sharp containers.	1.29	.460	P
10. Taking unwanted drugs and supplies to a dialysis center for disposal.	1.89	.567	M
11. Clean resources must be kept separate from contaminating tools and equipment.	2.00	.000	M
12. Surfaces at the dialysis unit are cleaned and disinfected.	2.96	.189	G
2. Dialysis machine equipment			
13. Checking the dialysis machine for fluid contamination, including the transducer protector.	1.46	.508	P
14. Dedicated machines are required for patients infected with HCV, provided cleaning and disinfection procedures are strictly adhered to between patients.	1.29	.460	P
15. External protection on blood circulation pressure lines must be checked by healthcare providers.	1.68	.476	M
16. Cleaning the dialysis device should only be done at the start of each day.	1.21	.418	P
17. Patients who are known to be infected with the HB virus might use separate washing machines.	2.00	.000	M
18. HBV washing machines can be used again for uninfected patients after being decontaminated.	1.29	.460	P
3. Surveillance of patients in hemodialysis unit			
19. Dialyzing patients with HBV infection should not be done at the same time as dialyzing patients without HBV infection.	2.18	.390	M
20. All patients who start dialysis or return to dialysis after treatment in another way should be negatively known for HBV plasma surface antigen before dialysis in the main dialysis unit.	1.71	.460	M
21. All patients beginning hemodialysis or returning to hemodialysis after another kind of treatment should be tested for HCV.	2.18	.390	M

22. Immunity can be screened for patients who do not have specific risk factors for hepatitis C virus.	1.75	.441	M
23. Patients who need dialysis before the HBsAg test results are available should always be dialyzed in the central dialysis unit.	1.61	.497	P
24. Whenever a new individual with HBV infection is found, the individual is sent to an HBV expert for further evaluation of antiviral medication.	2.07	.604	M
25. For all patients, units may want to screen for HBsAg every 6 months.	1.25	.441	P
26. Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months.	1.29	.460	P
27. Health measures should be observed directly or through contaminated surfaces or materials to effectively avoid the spread of contaminated blood among patients.	2.04	.637	M
28. Whenever a new episode of BBV contamination in a dialysis unit is discovered, cleaning and disinfection protocols should not be reviewed.	1.21	.418	P
4. Separation of patients			
29. Patients who refuse BBV screening must have dialysis in a separate area unless they have been confirmed to have been HBV immune in the previous 6 months.	1.75	.441	P
30. Dialysis for HBV-infected patients must take place in a separate space from the general dialysis unit.	2.43	.504	G
31. Patients with HCV should be dialyzed in a separate room to ensure infection control and that universal measures are followed.	1.46	.508	P
32. Staff members are at a substantially higher risk of contracting HCV infection than they are of contracting HBV infection.	1.43	.504	P
5. Immunizations and medications			
33. Patients who are HBV infective can't be dialyzed by workers who are not immune to HBV or infected with the virus.	1.57	.504	P
34. All dialysis patients should be tested for current or previous Hepatitis B infection and, if necessary, administered the HBV vaccine.	2.79	.418	G
35. Low dosages, repeated doses, or both are used in the primary HBV vaccination programs.	1.21	.418	P

36. The immunizations are given intramuscularly (deltoid muscle) as per the manufacturer's instructions.	1.32	.548	P
37. Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.	1.57	.504	P
38. Patients who are nonresponders to vaccines should be tested at least every 6 months.	1.57	.504	P
39. HBV vaccination should be given to all members who have clinical interaction with clients.	2.96	.189	G
40. After a single use, vials must be disposed of, and multi-use vials must be prevented.	2.18	.612	M
41. If a single drug vial is used to treat many patients, it is divided into numerous dosages and supplied from a central location.	1.61	.497	P
42. Intravenous medicine vials that are labeled for one use could be punctured several times.	1.36	.488	P

N (96), mean of score (3), cut off point (0.66), poor, (mean of score 1-1.66), moderate (mean of score 1.67-2.33), good (mean of score more than 2.33).

The table above presented the mean score for nurses' knowledge of all items of preventive measures and precautions for hepatitis B and C for all items in the hemodialysis unit at Basrah province study sample.

Table 4.12: Mean score of nurses' knowledge regarding preventive measures and precautions against viral hepatitis B and C in Basrah province.

Level of knowledge	F	%	M.S	S.D	Ass.
Poor	13	30.95	1.834	.21477	M
Moderate	20	47.63			
Good	9	21.42			
total	42	100			

The table presented the assessment of nurses' knowledge at hemodialysis unit in Basrah province is moderate with a mean score of (1.834).

Table 4.13. Assessment of nurse's knowledge regarding all domains of hepatitis B and C preventive measures and precautions in Basrah province in Hemodialysis Units.

No	Domains	M.S	Assessment
1	Universal precautions	2.40	Good
2	Dialysis machine equipment	1.48	Poor
3	Surveillance of patients in hemodialysis unit	1.72	Moderate
4	Separation of patients	1.76	Moderate
5	Immunizations and medications	1.81	Moderate

This table shows that the universal precautions domain has a high mean score (2.40), while the dialysis machine equipment domain has the lowest mean score (1.48).

Table 4.14. The mean score of all the items of nurses' knowledge regarding hepatitis B and C preventive measures and precautions in Hemodialysis Unit in Maysan province.

Items	M	St. D	Ass.
1.Universal precautions			
1. Hand washing after interaction with a patient, blood, fluids, or potential blood-contaminated objects or materials.	3.00	.000	G
2. When dealing with a patient or contacting the dialysis machine, sterile gloves must be worn.	3.00	.000	G
3. Change gloves and handwashing between patients on a regular basis.	3.00	.000	G
4. Disposable plastic aprons or waterproof robes should really be utilized when splashes involving blood or other fluids are a possibility.	3.00	.000	G
5. When blood, secretions, or infected tissue are likely to spray on the face, use eye protection.	2.86	.351	G
6. Any cuts or abrasions should be covered with plaster.	2.82	.395	G

7. Sharps should be disposed of immediately and safely in puncture-proof sharp containers.	2.77	.429	G
8. Sharp containers must be filled before disposal.	1.36	.492	P
9. The needle cover must be returned before throwing in sharps containers.	1.45	.510	P
10. Taking unwanted drugs and supplies to a dialysis center for disposal.	2.05	.486	M
11. Clean resources must be kept separate from contaminating tools and equipment.	2.00	.000	M
12. Surfaces at the dialysis unit are cleaned and disinfected.	3.00	.000	G
2. Dialysis machine equipment			
13. Checking the dialysis machine for fluid contamination, including the transducer protector.	1.55	.510	P
14. Dedicated machines are required for patients infected with HCV, provided cleaning and disinfection procedures are strictly adhered to between patients.	1.64	.492	P
15. External protection on blood circulation pressure lines must be checked by healthcare providers.	1.73	.456	M
16. Cleaning the dialysis device should only be done at the start of each day.	1.45	.510	P
17. Patients who are known to be infected with the HB virus might use separate washing machines.	2.00	.000	M
18. HBV washing machines can be used again for uninfected patients after being decontaminated.	1.50	.512	P
3. Surveillance of patients in hemodialysis unit			
19. Dialyzing patients with HBV infection should not be done at the same time as dialyzing patients without HBV infection.	2.64	.492	G
20. All patients who start dialysis or return to dialysis after treatment in another way should be negatively known to the HBV plasma surface antigen before dialysis in the main dialysis unit.	1.91	.294	M
21. All patients beginning hemodialysis or returned to hemodialysis after another kind of treatment should be tested for HCV.	2.64	.492	G
22. Immunity can be screened for patients who do not have specific risk factors for hepatitis C virus.	1.91	.294	M
23. Patients who need dialysis before the HBsAg test results are available should always be dialyzed in the central dialysis unit,	1.86	.351	M

24. Whenever a new individual with HBV infection is found, the individual is sent to an HBV expert for further evaluation of antiviral medication.	2.59	.796	M
25. For all patients, units may want to screen for HBsAg every 6 months.	1.77	.429	M
26. Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months.	1.86	.351	M
27. Health measures should be observed directly or through contaminated surfaces or materials to effectively avoid the spread of contamination blood among patients.	2.64	.727	G
28. Whenever a new episode with BBV contaminated in a dialysis unit is discovered, cleaning and disinfection protocols should not be reviewed.	1.77	.429	M
4. Separation of patients			
29. Patients who refuse BBV screening must have dialysis in a separate area unless they have been confirmed to have been HBV immune in the previous 6 months.	1.86	.351	M
30. Dialysis for HBV-infected patients must take place in a separate space from the general dialysis unit.	2.32	.477	M
31. Patients with HCV should be dialyzed in a separate room to ensure infection control and that universal measures are followed.	1.59	.503	P
32. Staff members are at a substantially higher risk of contracting HCV infection than they are of contracting HBV infection.	1.68	.477	M
5. Immunizations and medications			
33. Patients who are HBV infective can't be dialyzed by workers who are not immune to HBV or infected with the virus.	1.73	.456	M
34. All dialysis patients should be tested for current or previous Hepatitis B infection and, if necessary, administered the HBV vaccine.	3.00	.000	G
35. Low dosages, repeated doses, or both are used in the primary HBV vaccination programs.	1.68	.477	M
36. The immunizations are given intramuscularly (deltoid muscle) as per the manufacturer's instructions.	2.18	.795	M
37. Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.	1.68	.477	M

38. Patients who are nonresponders to vaccines should be tested at least every 6 months.	1.55	.510	P
39. HBV vaccination should be given to all members who have clinical interaction with clients.	3.00	.000	G
40. After a single use, vials must be disposed of, and multi-use vials must be prevented.	2.86	.351	G
41. If a single drug vial is used to treat many patients, it is divided into numerous dosages and supplied from a central location.	2.91	.294	G
42. Intravenous medicine vials that are labeled for one use could be punctured several times.	1.86	.351	M

N (96), mean of score (3), cut off point (0.66), poor, (mean of score 1-1.66), moderate (mean of score 1.67-2.33), good (mean of score more than 2.33).

The above table presents the mean score for nurses' knowledge of all items of preventive measures and precautions for hepatitis B and C in the hemodialysis unit at Maysan province study sample.

Table 4.15: Mean score of nurse knowledge regarding preventive measures and precautions against viral hepatitis B and C in Maysan province.

Level of knowledge	F	%	M.S	S.D	Assessment
Poor	**8**	**19.06**	**2.082**	**.21802**	**Moderate**
Moderate	**19**	**45.23**			
Good	**15**	**35.71**			
total	**42**	**100**			

The table above shows the nurses' knowledge of hemodialysis unit in Maysan province is moderate with a mean score of (2.082).

Table 4.16. Assessment of nurse's knowledge regarding all domains of hepatitis B and C preventive measures and precautions in Maysan province in Hemodialysis Units.

No	Domains	M.S	Assessment
1	Universal precautions	2.52	Good
2	Dialysis machine equipment	1.64	Poor
3	Surveillance of patients in hemodialysis unit	2.15	Moderate
4	Separation of patients	1.86	Moderate
5	Immunizations and medications	2.24	Moderate

The finding of this table shows that the universal precautions domain has a high mean score (2.52), while the dialysis machine equipment domain has the lowest mean score (1.64).

Table 4.17. The mean score of all the items of nurses' knowledge regarding hepatitis B and C preventive measures and precautions in the hemodialysis unit in Dhi-Qar province..

Items	**M**	**St. D**	**Ass.**
1.Universal precautions			
1. Hand washing after interaction with a patient, blood, fluids, or potential blood-contaminated objects or materials.	3.00	.000	G
2. When dealing with a patient or contacting the dialysis machine, sterile gloves must be worn.	3.00	.000	G
3. Change gloves and handwashing between patients on a regular basis.	3.00	.000	G
4. Disposable plastic aprons or waterproof robes should really be utilized when splashes involving blood or other fluids are a possibility.	3.00	.000	G
5. When blood, secretions, or infected tissue are likely to spray on the face, use eye protection.	2.91	.284	G

6. Any cuts or abrasions should be covered with plaster.	2.77	.426	G
7. Sharps should be disposed of immediately and safely in puncture-proof sharp containers.	2.74	.443	G
8. Sharp containers must be filled before disposal.	1.63	.598	P
9. The needle cover must be returned before throwing in sharp containers.	1.71	.572	M
10. Taking unwanted drugs and supplies to a dialysis center for disposal.	2.09	.658	M
11. Clean resources must be kept separate from contaminating tools and equipment.	2.46	.505	G
12. Surfaces at the dialysis unit are cleaned and disinfected.	3.00	.000	G
2. Dialysis machine equipment			
13. Checking the dialysis machine for fluid contamination, including the transducer protector.	2.09	.507	M
14. Dedicated machines are required for patients infected with HCV, provided cleaning and disinfection procedures are strictly adhered to between patients.	2.06	.639	M
15. External protection on blood circulation pressure lines must be checked by healthcare providers.	1.91	.507	M
16. Cleaning the dialysis device should only be done at the start of each day.	1.94	.838	M
17. Patients who are known to be infected with the HB virus might use separate washing machines.	2.31	.530	M
18. HBV washing machines can be used again for uninfected patients after being decontaminated.	1.86	.810	M
3.Surveillance of patients in hemodialysis unit			
19. Dialyzing patients with HBV infection should not be done at the same time as dialyzing patients without HBV infection.	2.71	.458	G
20. All patients who start dialysis or return to dialysis after treatment in another way should be negatively known to HBV plasma surface antigen before dialysis in the main dialysis unit.	2.43	.558	G
21. All patients beginning hemodialysis or returning to hemodialysis after another kind of treatment should be tested for HCV.	2.77	.426	G
22. Immunity can be screened for patients who do not have specific risk factors for hepatitis C virus.	2.29	.667	M

23. Patients who need dialysis before the HBsAg test results are available should always be dialyzed in the central dialysis unit.	2.03	.664	M
24. Whenever a new individual with HBV infection is found, the individual is sent to an HBV expert for further evaluation of antiviral medication.	2.34	.639	G
25. For all patients, units may want to screen for HBsAg every 6 months.	2.17	.857	M
26. Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months.	1.94	.639	M
27. Health measures should be observed directly or through contaminated surfaces or materials to effectively avoid the spread of contaminated blood among patients.	2.60	.736	G
28. Whenever a new episode of BBV contamination in a dialysis unit is discovered, cleaning and disinfection protocols should not be reviewed.	1.80	.677	M
4. Separation of patients			
29. Patients who refuse BBV screening must have dialysis in a separate area unless they have been confirmed to have been HBV immune in the previous 6 months.	2.34	.684	M
30. Dialysis for HBV-infected patients must take place in a separate space from the general dialysis unit.	2.60	.497	G
31. Patients with HCV should be dialyzed in a separate room to ensure infection control and that universal measures are followed.	1.60	.775	P
32. Staff members are at a substantially higher risk of contracting HCV infection than they are of contracting HBV infection.	1.86	1.004	M
5. Immunizations and medications			
33. Patients who are HBV infective can't be dialyzed by workers who are not immune to HBV or infected with the virus.	1.86	.494	M
34. All dialysis patients should be tested for current or previous Hepatitis B infection and, if necessary, administered the HBV vaccine.	2.97	.169	G
35. Low dosages, repeated doses, or both are used in the primary HBV vaccination programs.	1.71	.622	M
36. The immunizations are given intramuscularly (deltoid muscle) as per the manufacturer's instructions.	2.06	.906	M
37. Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.	2.20	.759	M

38. Patients who are nonresponders to vaccines should be tested at least every 6 months.	2.29	.750	M
39. HBV vaccination should be given to all members who have clinical interaction with clients.	3.00	.000	G
40. After a single use, vials must be disposed of, and multi-use vials must be prevented.	2.46	.505	G
41. If a single drug vial is used to treat many patients, it is divided into numerous dosages and supplied from a central location.	2.57	.608	G
42. Intravenous medicine vials that are labeled for one use could be punctured several times.	2.09	.612	M

N (96), mean of score (3), cut off point (0.66), poor, (mean of score 1-1.66), moderate (mean of score 1.67-2.33), good (mean of score more than 2.33).

This table illustrates the mean score for nurses' knowledge of all items of preventive measures and precautions for hepatitis B and C for all items in the hemodialysis unit at Dhi-Qar province study sample.

Table 4.18: Mean score of nurse knowledge regarding preventive measures and precautions for viral hepatitis B and C in Dhi-Qar province in the Hemodialysis Unit.

Level of knowledge	F	%	M.S	S.D	Ass.
Poor	2	4.76	2.266	.37399	Moderate
Moderate	21	50			
Good	19	45.23			
total	42	100			

The table revealed the assessment of nurses' knowledge at the hemodialysis unit in Dhi-Qar province was moderate with a mean score of (2.266).

19. Assessment of nurse's knowledge regarding all domains of hepatitis B and C preventive measures and precautions at the hemodialysis unit in Dhi-Qar province.

No	Domains	M S	Assessment
1	Universal precautions	2.60	Good
2	Dialysis machine equipment	2.01	moderate
3	Surveillance of patients in hemodialysis unit	2.30	Moderate
4	Separation of patients	2.1	Moderate
5	Immunizations and medications	2.32	Moderate

This table demonstrates that the universal precautions domain has a high mean score (2.60), while the dialysis machine equipment domain has the lowest mean score (2.01).

Table 4.20. The mean score of all the items of knowledge regarding hepatitis B and C preventive measures and precautions in the hemodialysis unit in AL-Muthanna province.

Items	M	St. D	Ass.
1. Universal precautions			
1. Hand washing after interaction with a patient, blood, fluids, or potential blood-contaminated objects or materials.	3.00	.000	G
2. When dealing with a patient or contacting the dialysis machine, sterile gloves must be worn.	3.00	.000	G
3. Change gloves and handwashing between patients on a regular basis.	3.00	.000	G
4. Disposable plastic aprons or waterproof robes should really be utilized when splashes involving blood or other fluids are a possibility.	3.00	.000	G
5. When blood, secretions, or infected tissue are likely to spray on the face, use eye protection.	3.00	.000	G
6. Any cuts or abrasions should be covered with plaster.	2.73	.467	G

7. Sharps should be disposed of immediately and safely in puncture-proof sharp containers.	2.73	.467	G
8. Sharp containers must be filled before disposal.	1.91	.701	M
9. The needle cover must be returned before throwing in sharp containers.	2.09	.701	M
10. Taking unwanted drugs and supplies to a dialysis center for disposal.	2.18	.751	M
11. Clean resources must be kept separate from contaminating tools and equipment.	2.45	.522	G
12. Surfaces at the dialysis unit are cleaned and disinfected.	3.00	.000	G
2. Dialysis machine equipment			
13. Checking the dialysis machine for fluid contamination, including the transducer protector.	2.18	.751	M
14. Dedicated machines are required for patients infected with HCV, provided cleaning and disinfection procedures are strictly adhered to between patients.	2.00	.894	M
15. External protection on blood circulation pressure lines must be checked by healthcare providers.	2.27	.467	M
16. Cleaning the dialysis device should only be done at the start of each day.	2.18	.874	M
17. Patients who are known to be infected with the HB virus might use separate washing machines.	2.36	.505	G
18. HBV washing machines can be used again for uninfected patients after being decontaminated.	2.18	.874	G
3. Surveillance of patients in hemodialysis unit			
19. Dialyzing patients with HBV infection should not be done at the same time as dialyzing patients without HBV infection.	2.73	.467	G
20. All patients who start dialysis or return to dialysis after treatment in another way should be negatively known to the HBV plasma surface antigen before dialysis in the main dialysis unit.	2.27	.786	M
21. All patients beginning hemodialysis or returning to hemodialysis after another kind of treatment should be tested for HCV.	2.73	.467	G
22. Immunity can be screened for patients who do not have specific risk factors for hepatitis C virus.	2.36	.505	G
23. Patients who need dialysis before the HBsAg test results are available should always be dialyzed in the central dialysis unit.	2.18	.603	M
24. Whenever a new individual with HBV infection is found, the individual is sent to an HBV expert for further evaluation of antiviral medication.	2.45	.688	G

25. For all patients, units may want to screen for HBsAg every 6 months.	2.18	.751	M
26. Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months.	2.18	.405	M
27. Health measures should be observed directly or through contaminated surfaces or materials to effectively avoid the spread of contaminated blood among patients.	2.64	.674	G
28. Whenever a new episode of BBV contamination in a dialysis unit is discovered, cleaning and disinfection protocols should not be reviewed.	1.91	.701	M
4. Separation of patients			
29. Patients who refuse BBV screening must have dialysis in a separate area unless they have been confirmed to have been HBV immune in the previous 6 months.	2.36	.674	G
30. Dialysis for HBV-infected patients must take place in a separate space from the general dialysis unit.	2.64	.505	G
31. Patients with HCV should be dialyzed in a separate room to ensure infection control and that universal measures are followed.	1.73	.905	M
32. Staff members are at a substantially higher risk of contracting HCV infection than they are of contracting HBV infection.	1.91	.944	M
5. Immunizations and medications			
33. Patients who are HBV infective can't be dialyzed by workers who are not immune to HBV or infected with the virus.	2.00	.632	M
34. All dialysis patients should be tested for current or previous Hepatitis B infection and, if necessary, administered the HBV vaccine.	2.91	.302	G
35. Low dosages, repeated doses, or both are used in the primary HBV vaccination programs.	2.18	.751	M
36. The immunizations are given intramuscularly (deltoid muscle) as per the manufacturer's instructions.	2.55	.820	G
37. Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.	2.27	.786	M
38. Patients who are nonresponders to vaccines should be tested at least every 6 months.	2.45	.688	G
39. HBV vaccination should be given to all members who have clinical interaction with clients.	3.00	.000	G

40. After a single use, vials must be disposed of, and multi-use vials must be prevented.	2.55	.522	G
41. If a single drug vial is used to treat many patients, it is divided into numerous dosages and supplied from a central location.	2.73	.467	G
42. Intravenous medicine vials that are labeled for one use could be punctured several times.	2.36	.505	G

N (96), mean of score (3), cut off point (0.66), poor, (mean of score 1-1.66), moderate (mean of score 1.67-2.33), good (mean of score more than 2.33).

The table above shows the mean score for nurse's knowledge regarding preventive measures and precautions for hepatitis B and C for all items in the hemodialysis unit at Muthanna province study sample.

Table 4.21. Assessment of nurses' knowledge regarding preventive measures and precautions for viral hepatitis B and C at a hemodialysis unit in Muthanna province.

Level of knowledge	F	%	M.S	S.D	Ass
Poor	**0**	**0**	**2.332**	**.45135**	**Good**
Moderate	**17**	**40.47**			
Good	**25**	**59.52**			
total	**42**	**100**			

The table above presented the assessment of nurses' knowledge at the hemodialysis unit in Muthanna province is good with a mean score of (2.332).

Table 4. 22. The level of nurse's knowledge regarding hepatitis B and C preventive measures and precautions regarding all domains at the hemodialysis unit in AL-Muthanna province.

No	Domains	MS	Assessment
1	Universal precautions	2.65	Good
2	Dialysis machine equipment	2.13	moderate
3	Surveillance of patients in hemodialysis unit	2.32	Moderate
4	Separation of patients	2.13	Moderate
5	Immunizations and medications	2.43	Moderate

This table shows that the universal precautions domain has a high mean score (2.65), while the dialysis machine equipment and separation of patients domains have the lowest mean score (2.13).

Table 4.23. Association between nurses' knowledge regarding hepatitis B & C preventive measures and their gender.

		Level of Knowledge			Total	Pearson Chi-Square		
		poor	moderate	good		value	df	sig.
gender	male	4	42	18	64	.708	2	.702
	female	1	20	11	32			
Total		5	62	29	96			

This table shows that there was no significant relationship between gender and the knowledge of nurses at p-value 0.05 as the table above shows.

T**able 4.24. Association between nurses' knowledge regarding hepatitis B & C preventive measures and their age.**

		Level of Knowledge			Total	Pearson Chi-Square		
		P	M	G		value	df	Sig.
Age	21-25	1	16	5	22	3.,495	8	.900
	26-30	2	21	8	31			
	31-35	1	8	5	13			
	36-40	0	10	5	15			
	41& more	1	7	6	14			
Total		5	62	29	96			

The table above shows that there is no relationship between nurse's knowledge and age at p-value 0.05.

Table 4.25. Association between nurses' knowledge regarding hepatitis B & C preventive measures and their level of education.

		Level of Knowledge			Total	Pearson Chi-Square		
		poor	moderate	good		value	df	Sig.
Level of education	Secondary school	5	22	0	29	54.182	4	.000
	institute	0	39	10	49			
	university	0	1	19	20			
Total		5	62	29	96			

This table shows that there was a significant relationship between the level of education and the knowledge of nurses at p-value 0.05 as the table above shows.

Table 4.26. Association between nurses' knowledge regarding hepatitis B & C preventive measures and their years of experience.

		Level of Knowledge			Total	Pearson Chi-Square		
		poor	moderate	good		value	df	Sig.
Years of experiences	1-5	3	25	12	40	1.488	4	.829
	6- 10	1	22	8	31			
	11-15	1	15	9	25			
Total		5	62	29	96			

There was no significant relationship between years of experience and the knowledge of nurses at p-value 0.05 as the table above shows.

Table 4. 27. Association between nurses' knowledge regarding hepatitis B & C preventive measures and their training sessions.

		Level of Knowledge			Total	Pearson Chi-Square		
		poor	moderate	good		value	df	Sig
Training session	Yes	0	30	27	57	24.10	2	.000
	No	5	32	2	39			
Total		5	62	29	96			

There was a significant relationship between training sessions and the knowledge of nurses at p-value 0.05 as the table above shows.

Table 4. 28. Results of analysis of variance (ANOVA).

	N	Mean	St deviation	F	p-value	Sig
Basrah	28	1.834	.21477	11.687	**.001**	H.S
Maysan	22	2.082	.21802			
Dhi-Qar	35	2.266	.37399			
Muthanna	11	2.332	.45135			

N: Number, F ANOVA, P value: probability value, Sig: significant

This table shows that there are significant differences among nurses' knowledge in four provinces' hemodialysis units.

Table 4. 29. Results of Post Hoc multiple comparison (Scheffe test) among four provinces.

Province	Hemodialysis unit	Mean differences	p- value	Sig
Maysan	Basrah	.27307*	**.030**	**Sig**
Dhi-Qar	Basrah	.42759*	**.001**	**Sig**
	Maysan	.15451	.356	No sig
Muthanna	Basrah	.49060*	**.001**	**Sig**
	Maysan	.21753	.323	No sig
	Dhi-Qar	.06302	.952	No sig

P value: probability value, sig: significant

The table above shows the significant differences between the Basrah hemodialysis unit and other hemodialysis units.

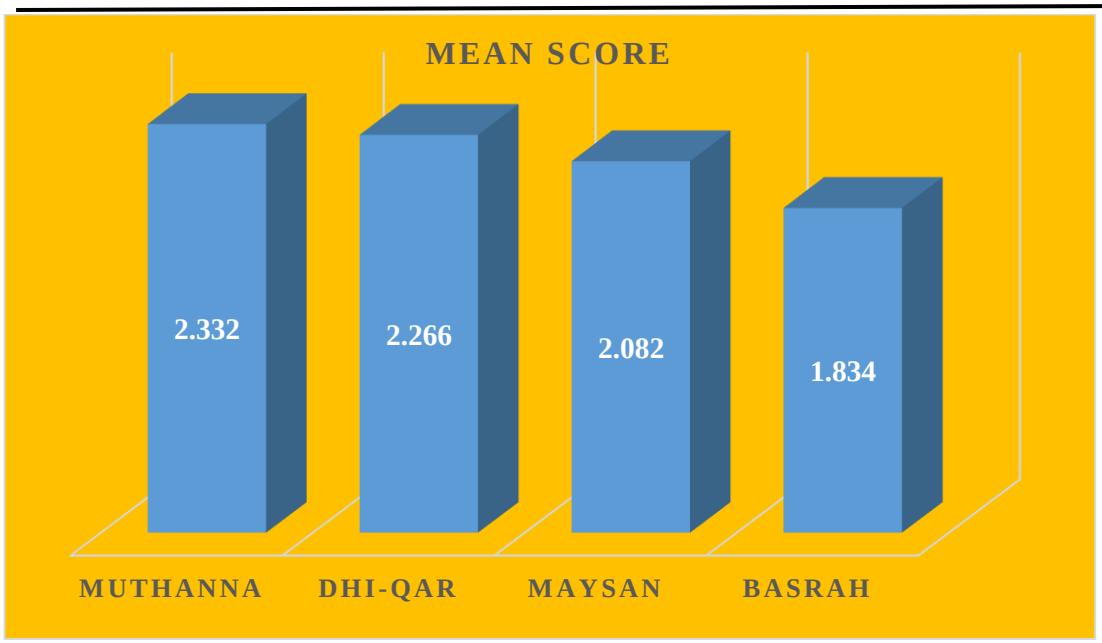

Figure (4.2). Mean score among hemodialysis units in four provinces in the south of Iraq.

Chapter Five

Discussion of The Results

Chapter five
Discussion of the Results

This chapter presents a systematically organized interpretation and reasonably derived discussion of the results with the support of the available literature and related studies.

5.1. Part one: Discussion of Socio-Demographic Characteristics of nurses' knowledge regarding preventive measures and precautions for viral hepatitis B and C in hemodialysis units.

The current study included a total number of (96) nurses who participated in this study. The majority of the sample (36.5%) was from Dhi-Qar province, with an average age of 26-30 years old. The highest proportion (66.7%) of them were male (Table 4.1). This result agreed with the studies of Mohammed & Hassan, (2014), Al-Fatlawy, (2001), and Al-Mansory & Al-Ani, (2006), which found that most nurses in dialysis units were males. Athbi Mohammed, (2010) found the same result and his research "Effect of Infection Control Education Program on Nurses' Staff's Knowledge in Hemodialysis Units in Baghdad Teaching Hospitals" revealed that the high percentage (60%) were males.

Regarding the level of education, the majority of the sample graduated from nursing institutes (51.0%), (53.6%), and (86.4%) as shown in tables (4.1, 4.2, and 4.3) respectively. While the majority of the sample graduated from nursing college (42.9%), and (54.5%) as shown in tables (4.4, and 4.5) respectively. This may be because nurses who graduated from nursing college in these provinces have fewer Compared to other nurses, they still make up a small percentage of the workforce. Many earlier

research supported these findings, finding that the bulk of the participants in the study were nurses who had completed their education at a nursing institute (Sharif *et al*., 2016; Naseer & Hassan, 2015).

The study results showed that the majority of nurses have between 1-5 years of experience with a percentage of (41.7%), (39.3%), (45.5%), and (51.4%), as shown in table (4.1, 4.2, 4.3, and 4.4), respectively. These findings were supported by a number of earlier investigations. They discovered that the vast majority of study samples were with (1-5) years of experience (Al-Fatlawy, 2001).

Regarding training sessions, the study shows that (59.37%), (64.28%), (22.72%), (74.67%), and (54.54%) are enrolled in training sessions as shown in tables (4.1, 4.2, 4.3, 4.4, and 4.5), respectively. This affects nurse knowledge because training courses are essential for increasing knowledge and skills, as well as assisting nurses in keeping updated. This result is supported by a study conducted by Hadi Atiyah and Abdul-Wahhab, (2016) who concluded that nurses' knowledge of mechanical ventilators was statistically associated with training course and by Ahmed and Abosamra, (2015) who indicated that there is a strong correlation between previous training sessions and the knowledge of nurses.

Table (4.6) shows the highest number of nurses in Dhi Qar (12), the lowest number in Muthanna (3), and the highest number of shifts in Dhi Qar (4). The table also shows the highest number of patients per shift in Basrah (35) and the lowest number in Muthanna (8). Finally, the table shows the time between one shift and another in Muthanna is the highest (120) minutes, while in Basrah it is the lowest (35) minutes.

The results of (Table 4.7) show the highest percentage of viral hepatitis in the Basrah hemodialysis unit (23.70%), while the lowest percentage was in the Muthanna hemodialysis unit (8.92%).

The findings of the results of these two tables (Table 4.6, 4.7) indicated that there was a significant association between the number of infected patients and the time between shifts. That is, the less time between shifts, the more infected patients (Figure 4.1).

Garthwaite *et al*., (2019) recommended that the duration between shifts should be long enough to allow for effective cleaning of machines and surfaces. Dialysis devices must be maintained among patients, however, according to local tradition, which includes following the maintenance schedule. Maintaining hemodialysis devices and equipment among patients is a crucial step in reducing the chances of transmission.

5.2 .Part two: Discussion of mean of the score of the nurse's knowledge regarding hepatitis B and C preventives measures and precautions in Hemodialysis Units at four provinces.

The results of the present study indicated that the overall assessment of the nurse's knowledge regarding preventive measures and precautions for viral hepatitis B and C in four provinces in hemodialysis units was moderate with a mean score of (2.25) (Table 4.9). In regard to the results in (Table 4.12, 4.15, 4.18, 4.21), these tables show that there are significant differences between the mean scores of four provinces (1.91), (2.18), (2.33), and (2.40) respectively. These results take place because there are differences in the level of nursing graduates in four provinces.

5.2.1 .First domain: Universal precautions

The overall assessment of the first domain, which represented universal precautions, was good with a mean score of (2.53), (2.40), (2.52), (2.60), and (2.65) as shown in the table (4.10, 4.13, 4.16.4.19, and 4.22) respectively.

Froio *et al*., (2003) found that the strict implementation of universal infection control protocols is the single most effective method of preventing the spread of blood-borne viruses. Garthwaite et al., (2019) revealed that hygienic measures must be used in infection management protocols to effectively avoid the patient-to-patient transfer of blood-infected materials, either directly or through contaminated surfaces as well as materials. Because of the considerable risk of blood contamination, the dialysis technique facilitates BBV transfer. Due to blood splashes that are not apparent to the naked eye, BBV may linger and perhaps remain pathogenic on components involving clinical equipment.

Alfurayh *et al*., (2000) indicated that hepatitis C virus on the hands of caregivers dialyzing patients has been discovered. While the hepatitis B and C viruses have been discovered in the dialysate of individuals with these diseases, there is no indication that BBV can be transferred through internal fluid channels. Implementation of universal precautions needs a lot of protective equipment, a lot of handwashing facilities, and a lot of nursing and cleaning health workers.

Studies by Petrosillo *et al*., (2001), and Saxena *et al*., (2003) in Italian and Saudi Arabian documented that hemodialysis centers indicated a strong relationship between HCV incidence and staffing levels, implying that insufficient staffing plays a major role in its spread.

5.2.2 .Second domain: Dialysis machine equipment

The overall assessment of the first domain, which represented dialysis machine equipment, was moderate with a mean score of (1.79) (Table 4.10), and there were significant differences among hemodialysis units in four provinces, from poor to moderate (1.48), (1.64), (2.01), and (2.18), as shown in tables (4.13, 4.16.4.19, and 4.22) respectively.

Thomson *et al*., (2011) presented that for patients infected with HCV, there is no information to support the use of dialysis equipment that is only used for dialysis. HCV can't be transmitted through the internal channels of current single-pass dialysis equipment.

Another study by Swanepoel *et al*., (2018) shows that, because the virus never flows through an unbroken dialyzer membrane, it must move from the drain tube to a new dialysis fluid circuit and then move via the hollow fiber membranes of a new patient in order to spread. HCV will have to pass through clean dialysate used for a later patient and penetrate that patient's blood compartments from back-filtration throughout the dialyzer tissue to transmit even if there was a blood leakage.

Zuniga and López, (2016) revealed that there is no need for dedicated machines for HCV patients as long as disinfection protocols are followed among patients.

5.2.3 .Third domain: Surveillance of patients in hemodialysis unit

The overall assessment of the third domain, which represented the surveillance of patients in hemodialysis units, was moderate with a mean score of (2.10), (1.72), (2.15), (2.30), and (2.32) as shown in table (4.10, 4.13, 4.16.4.19, and 4.22) respectively.

Garthwaite *et al*., (2019) recommended that healthcare staff performing hemodialysis on infected patients with Hepatitis B really shouldn't dialyze at the same time as patients without HBV. If this is not practicable, they should wear personal protective equipment and ensure proper disinfection before moving from one patient to the next.

Garthwaite *et al*., (2019) presented that all patients starting or returning to hemodialysis or resuming it after alternative treatment for kidney treatment must be tested for HBsAg before starting or returning to it.. Patients with no known causes for HCV infection may be screened, followed by a NAT if the serology is positive. NAT should detect patients with ongoing risk factors. Patients with HCV infection risk factors must be screened using NAT first, then serological techniques if there are no risk factors present. Patients with persistent risk factors, NAT screening must be continued.

Geddes *et al*., (2011) recommended that patients who receive regular hemodialysis in hospital, who are immune to viral hepatitis B, must have their HBsAg level checked every six months. Patients who do not respond or have poor reactions should be tested at least once every three months. It's tough to put in place a testing method that uses varying timings depending on antibody titres. As a result, units might like to do HBsAg tests every three months.

Chaves *et al.*, (2011) recommended that patient surveillance should be intensified if the person's condition is too high or if an infected individual encounters any incident which increases the chance. Furthermore, his research discovered that hepatitis B-protected patients on regular hemodialysis only require HBsAg testing once a year. Antibody titers, on the other hand, can drop with time, leaving some people unprotected.

Wheeler & Winkelmayer (2008) recommended that for normal-risk patients, HBsAg testing should be done at least every three months. In the great majority of dialysis, testing for HBsAg is adequate to diagnose HBV infection. Minuk *et al*., (2004) reported that occult HBV infection has been documented in 1.3–3.8 percent of chronic hemodialysis patients, according to the study. The incidence in the United Kingdom is much lower.

According to Garthwaite *et al*., (2019), patients having antibodies to the basic antibodies to hepatitis B are more likely to reactivate the virus than those who do not have antibodies to essential antibodies. Three months at least, this group of patients should be examined. During immunosuppressive, the chance of reactivating the virus is increased. The HBsAg exam should never be conducted within 14 days of obtaining the hepatitis B vaccination because the test may determine the vaccine, leading to concerns about the patient's infection. If tests and vaccinations are carried out at the same time, a sample must be taken before the vaccine is administered.

Wheeler & Winkelmayer, (2008) recommend that, if the patient had an HBsAb result of more than 100 mIU/mL throughout the last year, he doesn't need to have HBV monitoring increased. Antibody titres, on the other hand, can decrease over time, keeping some people unprotected. Furthermore, if other BBV contamination is reported at a hemodialysis unit, all patients who might be exposed must be screened for virus RNA or DNA.

Rahnavardi *et al*., (2008) showed that patients who are at a high risk of getting a new BBV infection must be continuously monitored. Patients on hemodialysis who have unexplained high blood aminotransferase levels should be examined for HBsAg as well as HCV RNA.

Couroucé *et al*., (2000) suggested that prior to the development of antibodies, new infections of BBV as well as, in particular, HCV patients may have elevated ALT levels. Baseline ALT monitoring followed by monthly ALT monitoring in vulnerable individuals has also been suggested as a way to help hemodialysis patients detect new HCV early.

Alter *et al*., (2001) indicated that when a new BBV infection is discovered, all other patients in the same facility should be evaluated right away to see if there are any other cases. Each at-risk client must be evaluated, and anyone who has never been infected should be tested for BBV. The number of repeated tests must be raised for a limited time. For example, 3 month testing every 3 months, then evaluating results again in three months, and six months of screening when no new infections are discovered.

Mbaeyi & Thompson, (2013) reported that when BBV transmission is discovered in a dialysis facility, infection control methods should be re-evaluated, and corrective action should be taken. Any specific results of BBV transmission discovered on hemodialysis must be submitted to the virology group for treatment to reduce individual and population threat.

5.2.4 .Forth domain: Separation of patients

The overall assessment of the fourth domain, which represented the separation of patients, was moderate with a mean score of (2.10), (1.76), (1.86), (2.1), and (2.13) as shown in table (4.10, 4.13, 4.16.4.19, and 4.22) respectively.

Garthwaite *et al.,* (2019) defined separation between cleaned and contaminated areas in a dialysis unit as essentially perfect with no opportunity for movement between both, and a protective border such as walls or screens was proposed to separate these clean and infected places.

A study by Geddes *et al*., (2011) revealed that when people infected with HBV are dialyzed among uninfected individuals, there is considerable evidence of horizontal as well as vertical HBV transmission. Furthermore, individuals diagnosed with HBV who were dialyzed in such a section of the dialysis unit other than the "clean" section had a lower risk of HBV transmission.

According to Garthwaite *et al*., (2019), when health-care staff are caring for both infected as well as uninfected patients at the same time, the infection has been observed. This is also critical for HBV-infected dialysis patients who are undergoing invasive procedures. These operations should be carried out in a separate area. Even though blood splashes aren't apparent to the human eye, BBV may thrive and remain infectious on the surface of material input. Any unneeded equipment brought into the room where the procedure took place (syringes, swabs, spare catheters) should be discarded.

Dialysis in a separate room is not required for HCV patients, according to Froio *et al*., (2003), as long as infection management and universal precautions are followed. HCV has a substantially lower risk of nosocomial transmission than HBV. HCV was discovered in the exterior region of an inlet-outlet contact despite the fact that there had been no sign of infection on a dialysis machine in use for HCV-uninfected individuals.

Fissell *et al*., (2004) study found revealed HCV serology was the same for both HCV-positive and HCV-negative patients whether they were isolated for hemodialysis or not. Similarly, prospective multicenter studies found that simply increasing universal measures without separation was enough to minimize HCV infection rates (Jadoul *et al*., 2004; Taal & van Zyl-Smit, 2000).

According to Stragier & Jadoul, (2003), the most crucial element associated with cross-contamination across equipment as well as surfaces as a result of infection control measures not being followed in HCV transmission between patients treated in the very same dialysis unit.

Karkar *et al*., (2014) study has not suggested routine isolating of HCV-infected individuals in a separated section to minimize HCV separation, and this result disagrees with Harmankaya *et al*., (2002) and Dzekova *et al*., (2012). The observational studies that have demonstrated a decrease in HCV transmission after isolation have had low quality results.

5.2.5 .Fifth domain: Immunizations and medications

The overall assessment of the fifth domain, which represented immunizations and medications, was moderate with a mean score of (1.81) (Table 4.10), and there were significant differences among hemodialysis units in four provinces from moderate to good (1.81), (2.24), (2.32), and (2.43) as shown in tables (4.13, 4.16.4.19, and 4.22) respectively.

Bernieh, (2015) indicated that employees who engage with customers in a clinical setting must be inoculated against HBV and show that they have been resistant to but not contaminated by the virus, according to the study. In order to conduct clinical activities, staff with an active HBV infection must receive occupational health clearance and be monitored on a regular schedule. They aren't usually allocated to work in a clinical position in a dialysis unit.

Garthwaite *et al*., (2019) recommended that every patient who requires renal replacement treatment for chronic kidney disease should be checked for Hepatitis B infection and, as required, given HBV vaccination. The implementation of HBV immunization was linked to a reduction in HBV infection rates in hemodialysis patients.

Ridley, (2008) presented that, in a randomized trial, immunization reduced HBV infection, while a case-controlled study reported a 70% reduction in overall HBV disease in patients who had received HBV vaccination compared with those who had not.

Grzegorzewska, (2012) revealed that the Hepatitis B vaccine is not recommended for anyone who has a current or proven HBV infection. Anti-HBc antibodies discovered in separation must not be mistaken for evidence of previous HBV infection. Vaccination may be required for patients who test positive for core antibodies and are at risk of HBV reactivation. Hepatitis B core antibody testing, on the other hand, should never be used to identify whether or not a patient is protected or has previously been infected; those individuals may experience vaccination.

Garthwaite *et al.,* (2019) recommended that any patient with a known previous HBV infection who will be severely immunosuppressed is at danger of recurrence, and a management approach with a Hepatitis B specialist must be created.

Micozkadioglu *et al*., (2007) indicated that the initial HBV immunization program should be used in high doses, frequent doses, or both. The vaccines are given using the permitted route (deltoid muscle), although if enough knowledge is available, the intradermal route may be more effective.

Oguz *et al.,* (2001) stated that although the schedules specified promote immunity as quickly as possible, some scheduling flexibility is available. For example, immunizations can be administered every three months to match with examinations. The most critical requirement is to wait at least four weeks between vaccinations one and two. Extending the vaccine schedule lengthens the duration of protection, while extended

periods across dosages increase immunological response. 4–8 weeks after their main immunization course, and regularly thereafter, with boosting dosages as required, patients were evaluated for evidence of reaction.

Garthwaite *et al*., (2019) recommended that non-responders to HBV immunization must not be vaccinated though because the advantage is restricted in comparison to the cost burden. Non-responders to a 4, 40-g protocol may, however, recover to a higher intradermal dose, according to some evidence. Non-responder patients who are not immune to HBV must be informed on how to decrease the danger of HBV transmission and what to do if they become infected with the virus.

Alter *et al*., (2001) indicated that after a single use, the vial must be disposed of, but more than once, vials must be eliminated. When a single medicine vial is used to treat a large number of patients, it is subdivided into many doses and administered from one location. Multiple punctures of intravenous injectable drug vials are not permitted since the cleanliness of the medication can't be ensured when a syringe has perforated a vial marked for single administration.

Lanini *et al*., (2009) revealed that the use of more than one vial of drugs has also been linked to unnecessary HBV and HCV epidemics by permitting syringes to be contaminated with contaminated patient's blood, which will then be passed to some other patient by some other needle. As a reason, multi-dose vials should also be avoided wherever available, and sterilized, singular, disposable needles should be used alternatively. If vials more than once drugs are utilized, they should be manufactured and distributed from a clean, central location away from the clinical service area.

Alter *et al*., (2001) indicated that, during the preparation and delivery of injectable medications, infection control procedures must be followed. If vials are used more than once, provide a written risk assessment and standard process.

5.3. Association between nurse's knowledge regarding hepatitis B & C preventives measures and their demographic data.

The results of the study illustrated that there has been no positive relationship between nurses' knowledge regarding preventive measures and precautions and their gender, age, and years of experience. These findings agree with (Al-Fatlawy, 2001; Al-Mansoary & Betool, (2006) who mentioned that there is really no link between a nurse's knowledge and his or her gender, age, and years of experience.

According to the data, there is a substantial link between nurse knowledge and the level of education and training sessions (Table. 4.24, 4.26) respectively. It has been expected that the higher the level of education preparation, the better the knowledge acquired. The results of the present study are supported by another study by Aydin & Karadag (2010) that indicated a significant correlation was found between the percentage of correct answers and the level of nursing education, and participation in training sessions. These results are supported by Sickder, (2010), who conducted a study in Bangladesh, stating that nurses' knowledge is significantly affected by their qualification.

Woldegioris *et al.,* (2019) indicated that learning institutions, and having taken training in infection prevention were significantly associated with a nurse’s knowledge. Furthermore, Balodimou *et al*., (2018) show that

there is now a substantial link between nurses' educational level and their understanding.

5.4 :One-way analysis of variance and Scheffe test

In response to the study hypothesis, there are statistically significant differences in nurses' knowledge according to hemodialysis units in the four provinces. To examine this question, the ANOVA test is used to discover nurses' knowledge levels differed statistically significantly depending on the hemodialysis units in four provinces.

Table (4.28) shows the test results and the statistical significance of one-way ANOVA test concludes that nurses' knowledge differs significantly in hemodialysis units at the provinces where the (f) value (11.687) with a probability value of 0,001 less than 0.05 statistically significant.in addition, the table shows the high value of mean for the largest province Muthanna with a mean of score (2.40) out of 3 degrees

It is clear from the table (4.29), and by using the Post Hoc multiple comparison (Scheffe) test, that the reason for the statistically significant differences in the nurses' knowledge among hemodialysis units is due to the difference between the nurses' knowledge in the hemodialysis unit in Basrah province and the other dialysis units in the other provinces, where the probability value came. While the difference between the hemodialysis units in other provinces was not statistically significant, the probability values between Maysan and Dhi Qar (0.356), Maysan and Muthanna (0.323), and Dhi Qar and Muthanna (0.952) were greater than 0.05.

Accordingly, through the results of tables (4.28), and (4.29), the research hypothesis is rejected, which states that the nurse's knowledge differs statistically significantly among hemodialysis units in the four southern provinces.

Chapter Six

Conclusions and Recommendations

Chapter six

Conclusion and recommendations

6.1. Conclusions:

The study includes the following conclusions according to the results:

1. The majority of the study nurses were from the hemodialysis unit in Basrah province (29.2%), male (66.7), had an age of (21.25), nursing institute graduate (51.0%), had (1.5) years of experience, and (59.7%) enrolled in training sessions.

2. The results of the study demonstrated the level of nurses' knowledge regarding preventive measures and precautions for hepatitis B and C was moderate with a mean score of (2.25).

3. The results of the study demonstrated the level of nurses' knowledge regarding preventive measures and precautions for hepatitis B and C was moderate with a mean score of (1.834) in the hemodialysis unit in Basrah province, moderate with a mean score of (2.082) in Maysan province, moderate with a mean score of (2.266) in Dhi-Qar province, and good with a mean score of (2.332) in Muthanna provinces.

4. The findings revealed that the higher the time between shifts in the hemodialysis unit in Muthanna province (120 min), the less time in the hemodialysis unit in Basrah province (30 min).

5. The findings indicated that the highest percentage of patients infected with viral hepatitis B and C in a hemodialysis unit in Basrah province (23.70%), and a lower percentage of infected patients in a hemodialysis unit in Muthanna province (8.92%).

6. The findings show that there is no significant association between gender, age, years of experience, and nurses' knowledge regarding preventive measures and precautions for viral hepatitis B and C.

7. The findings show that there is a significant association between level of education, training sessions, and nurses' knowledge regarding preventive measures and precautions for viral hepatitis B and C.

8. The findings demonstrate that nurses' knowledge differs significantly at hemodialysis units in four southern provinces in Iraq with a probability value of (.001).

6.2. Recommendations:

The findings and the conclusions of the study assisted the researcher to create the following recommendation.

1. Advising nurses to attend training programs to improve their knowledge and stay current on preventive measures and precautions regarding viral hepatitis B and C in the hemodialysis unit.

2. Nurses should participate in education courses to enhance their understanding so that they may engage in educating patients using the information received from the previous courses because they feel more at ease with nurses.

3. In hemodialysis units, the healthcare director should use continuing education initiatives to improve nurses' awareness of viral hepatitis B and C.

4. Special recommendations should be posted on the walls of the hemodialysis unit, where all nurses can see them, highlighting basic preventative measures and precautions for hepatitis B and C.

5. Nurses who have the highest educational levels should be assigned to work in hemodialysis units.

6. An instruction manual on preventive measures and precautions against hepatitis B and C should be published and delivered to patients with renal failure on hemodialysis therapy.

7. A handbook should be designed and distributed to all nurses working in hemodialysis units in order to improve their knowledge.

8. Furthermore, nationwide studies should be conducted with a large sample size relative to this study.

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Appendices

Appendix A: Study agreements

Ministry of Higher Education and Scientific Research

وزارة التعليم العالي والبحث العلمي

University of Babylon
College of Nursing

جامعة بابل
كلية التمريض
لجنة الدراسات العليا

Ref. No. :
Date: /

العدد : ١٦٨٧
التاريخ : ٢٠٢٠/٩/٨

الى / دائرة صحة البصرة – مركز التدريب والتنمية البشرية
م/ تسهيل مهمة

تحية طيبة :

يطيب لنا حسن التواصل معكم ويرجى تفضلكم بتسهيل مهمة طالب الدكتوراه (عبد الكريم سلمان خضير شوزلي) لغرض جمع عينة دراسة الدكتوراه والخاصة بالبحث الموسوم :

دراسة مقارنة لمعارف الممرضين المتعلقة بالتدابير الوقائية والاحتياطات من التهاب الكبد الفيروسي C و B في وحدات غسيل الكلى في محافظات العراق الجنوبية

A Comparative Study of Nurse's Knowledge regarding Preventive Measures and Precautions of Viral Hepatitis B and C at Hemodialysis Units among Southern Province of Iraq

مع الاحترام ..

الدكتور
حسام عباس داود
معاون العميد للشؤون العلمية والدراسات العليا
٢٠٢٠/٩/٨

صورة عنه الى //
- مكتب السيد العميد للتفضل بالاطلاع مع الاحترام .
- لجنة الدراسات العليا مع الأولويات .
- الصادرة

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وطني 07711632208
المكتب 009647711632208

Appendix B: Study agreements

Ministry of Higher Education and Scientific Research

وزارة التعليم العالي والبحث العلمي

University of Babylon
College of Nursing

جامعة بابل
كلية التمريض
لجنة الدراسات العليا

Ref. No. :
Date: /

العدد : ١٦٥٩٦
التاريخ : ٢٠٢٠/٩/٢٨

الى / دائرة صحة ميسان – مركز التدريب والتنمية البشرية
م/ تسهيل مهمة

تحية طيبة :

يطيب لنا حسن التواصل معكم ويرجى تفضلكم بتسهيل مهمة طالب الدكتوراه (عبد الكريم سلمان خضير شوزلي) لغرض جمع عينة دراسة الدكتوراه والخاصة بالبحث الموسوم :

دراسة مقارنة لمعارف الممرضين المتعلقة بالتدابير الوقائية والاحتياطات من التهاب الكبد الفيروسي C و B في وحدات غسيل الكلى في محافظات العراق الجنوبية

A Comparative Study of Nurse's Knowledge regarding Preventive Measures and Precautions of Viral Hepatitis B and C at Hemodialysis Units among Southern Province of Iraq

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معاون العميد للشؤون العلمية والدراسات العليا
٢٠٢٠/٩/٢٨

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- مكتب السيد العميد للتفضل بالاطلاع مع الاحترام .
- لجنة الدراسات العليا مع الأوليات .
- الصادرة .

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المكتب 009647711632208

Appendix C: Study agreements

Ministry of Higher Education and Scientific Research

وزارة التعليم العالي والبحث العلمي

جمهورية العراق

University of Babylon
College of Nursing

جامعة بابل
كلية التمريض

لجنة الدراسات العليا

Ref. No. :
Date: /

العدد : ١٦٢٥
التاريخ : ٢٠٢٠/٩/٢٨

الى / دائرة صحة ذي قار – مركز التدريب والتنمية البشرية التمريضي
م/ تسهيل مهمة

تحية طيبة :

يطيب لنا حسن التواصل معكم ويرجى تفضلكم بتسهيل مهمة طالب الدكتوراه (عبد الكريم سلمان خضير شوزلي) لغرض جمع عينة دراسة الدكتوراه والخاصة بالبحث الموسوم :

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A Comparative Study of Nurse's Knowledge regarding Preventive Measures and Precautions of Viral Hepatitis B and C at Hemodialysis Units among Southern Province of Iraq

مع الاحترام ..

الدكتور
حسام عباس داود
معاون العميد للشؤون العلمية والدراسات العليا
٢٠٢٠/٩/٢٨

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- الصادرة .

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Appendix D: Study agreements

Ministry of Higher Education and Scientific Research

وزارة التعليم العالي والبحث العلمي

University of Babylon
College of Nursing

جامعة بابل
كلية التمريض
لجنة الدراسات العليا

Ref. No. :
Date: /

العدد : ١٦٩٤
التاريخ : ٨ / ٤ / ٢٠٢٠

الى / دائرة صحة المثنى – مركز التدريب والتنمية البشرية
م/ تسهيل مهمة

تحية طيبة :
يطيب لنا حسن التواصل معكم ويرجى تفضلكم بتسهيل مهمة طالب الدكتوراه (عبد الكريم سلمان خضير شوزلي) لغرض جمع عينة دراسة الدكتوراه والخاصة بالبحث الموسوم :

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A Comparative Study of Nurse's Knowledge regarding Preventive Measures and Precautions of Viral Hepatitis B and C at Hemodialysis Units among Southern Province of Iraq

مع الاحترام ..

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٢٠٢٠/٩/٨

صورة عنه الى //
- مكتب السيد العميد للتفضل بالاطلاع مع الاحترام .
- لجنة الدراسات العليا مع الاولويات .
- العمادة .

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Appendix E: The questionnaire of the study

Hemodialysis unit in …… province

Part one: demographic data

1. Gender
2. Age
3. Level of education
   a. Secondary nursing school
   b. Nursing institute graduated
   c. College of nursing graduated

4. Years of experiences

5. Training session Yes No

6. Number of nurses in hemodialysis unit
7. Number of shift per day
8. Number of patients per shift
9. Number of nurses per shift
10. Time between shifts per minutes
11. Number of hemodialysis patients
12. Number of patients with hepatitis B
13. Number of patients with hepatitis C .
14. Number of patients with hepatitis B and C

Appendix E: The questionnaire of the study

Part two: Questionnaire about Knowledge of Nurses Regarding Universal Precautions in Hemodialysis Units.

	No.	items	Yes	Un Certain	No
Universal precautions (12 items) From 1. 12)	1	Hand washing after contact with patient, blood, body fluids or potentially blood-contaminated surfaces/ supplies			
	2	Wearing of disposable gloves whenever caring for a patient or touching dialysis equipment.			
	3	changing gloves and cleaning hands between patients every time			
	4	Wearing of disposable plastic aprons/impermeable gowns when splashing with blood or body fluids may occur.			
	5	Wear eye protectors (masks, goggles, or safety goggles) when blood, body fluids or contaminated tissue are likely to be splash on the face.			
	6	Staff should cover any cut or abrasions with waterproof plaster.			
	7	Immediate and safe disposal of sharps into appropriate puncture-proof sharps bins.			
	8	Sharp containers must be filled before disposal*.			
	9	The needle cover must be returned before throwing in sharps containers*.			
	10	Disposing of unused medications/ supplies (syringes/ swabs) taken to a dialysis station.			
	11	Adequate separation of clean supplies from contaminated materials and equipment			
	12	Cleaning and disinfection of surfaces at the dialysis station.			
	13	Inspection of dialysis machine including transducer protectors for contamination with blood.			
	14	Dedicated machines are required for patients infected with HCV, provided			

Appendix E: The questionnaire of the study

Dialysis machine equipment (5 items) From 13. 18		cleaning and disinfection procedures are strictly adhered to between patients*.			
	15	External transducer protectors on the blood circuit pressure monitoring lines should be inspected by healthcare personnel during and after each dialysis session.			
	16	The dialysis machine should be cleaned only at the beginning of every day*.			
	17	Separate washing machines can be used for patients known to be infected with hepatitis B virus.			
	18	HBV washing machines can be used again for uninfected patients after decontaminated.			
Surveillance of patients in hemodialysis unit (11 items) From 19.28	19	Healthcare workers dialyzing patients with HBV infection should not dialyze patients without hepatitis B virus infection at the same time.			
	20	All patients who start dialysis or return to dialysis after treatment in another way should be the HBV plasma surface antigen (HBsAg) known negatively before dialysis in the main dialysis unit.			
	21	HCV screening all patients starting hemodialysis or returning to hemodialysis after another modality of renal replacement therapy.			
	22	Immunity can be screening for patients who do not have specific risk factors for hepatitis C virus			
	23	Patients who require hemodialysis before the result of the HBsAg test is known should be dialyzed within the main dialysis unit*.			
	24	A new case of HBV infection is identified, the affected patient should be referred to HBV specialist for further evaluation and consideration of antiviral treatment.			
	25	For ease units may prefer to routinely test for HBsAg every 6 months for all patients.			

Appendix E: The questionnaire of the study

	26	Regular antibody testing should be performed on HCV patients who have dialysis at the hospital every 6 months*.			
	27	Health precautions that effectively prevent the transmission of blood or blood-contaminated fluids between patients should be observed either directly or through contaminated equipment or surfaces.			
	28	There should not be a review of cleaning and disinfection procedures when there is a new case of a BBV infection within a hemodialysis unit.			
Separation of patients (4 items) From 29. 32	29	Patients who do not consent to BBV surveillance, should have dialysis in a segregated area unless they are known to be HBV immune in the previous 6 months.			
	30	Patients infected with HBV must be dialyzed in an area that is segregated from the main dialysis unit.			
	31	Patients with HCV *need* to be dialyzed in a segregated area, providing infection control and universal precautions can be properly adhered to*.			
	32	Staff members are at much *higher* risk of acquiring HCV infection than HBV infection*.			
Immunizations and medications (8 items)	33	Staff that are not immune to HBV and are not HBV infective *can't* dialyze patients who are HBV infective*.			
	34	All patients who require dialysis should be assessed for current or past infection with Hepatitis B and offered vaccination against HBV if indicated.			
	35	The initial HBV immunization schedule should involve *low* doses, frequent doses or both of the available preparation*.			
	36	The vaccines are administered intramuscular as per their licensed route (deltoid muscle)*.			
	37	Regular dialysis patients in the hospital who are vaccinated against hepatitis B only need an HBsAg test every one year.			

Appendix E: The questionnaire of the study

From 33. 42	38	Patients how are nonresponders to vaccine should be tested at least every 6 months.			
	39	Staff members who have clinical contact with patients should be immunized against HBV.			
	40	Medicine vials should be discarded after single use and multi-use vials should be avoided.			
	41	If medicine vials are used for more than one patient, they are divided into multiple doses and distributed from a central area.			
	42	Intravenous medication vials labelled for single and use *can* be punctured more than once*.			

Appendix F: The questionnaire of the study

وحدة الانفاذ الدموي في محافظة .....

الجزء الاول: المعلومات الديمغرافية

1. **الجنس**
2. **العمر**
3. **المستوى التعليمي**
   - **أ. اعدادية تمريض**
   - **ب. معهد**
   - **ت. كلية تمريض**
4. **سنوات الخبرة**
5. **مشاركة في دورات تدريبية نعم لا**
6. **عدد الممرضين في الوحدة**
7. **عدد شفتات الانفاذ الدموي في اليوم**
8. **عدد المرضى في الشفت الواحد**
9. **عدد الممرضين في الشفت الواحد**
10. **الوقت بين شفت و اخر بالدقيقة**
11. **عدد مرضى الانفاذ الدموي الكلي**
12. **عدد المرضى المصابين بالتهاب الكبد الفيروسي نوع B**
13. **عدد المرضى المصابين بالتهاب الكبد الفيروسي نوع C**
14. **عدد المرضى المصابين بالتهاب الكبد الفيروسي نوع B و C**

Appendix F: The questionnaire of the study

N	Item	اعرف	غير متأكد	لا أعرف
1	غسل اليدين بعد الاتصال مع كل مريض و ملامسة الدم أو سوائل الجسم أو الأسطح/الإمدادات الملوثة بالدم.			
2	ارتداء قفازات(كفوف) معقمة كلما كانت هناك عناية بمريض أو لمس لمعدات غسيل الكلى.			
3	تغيير القفازات وتنظيف اليدين بين المرضى في كل مرة.			
4	ارتداء المآزر البلاستيكية التي يمكن التخلص منها / العباءات(الكاون) غير القابلة للاختراق عند التعرض لرش بالدم أو سوائل الجسم.			
5	ارتداء واقي العين (أقنعة، نظارات واقية، أو نظارات السلامة) عندم احتمال تناثر الدم أو سوائل الجسم أو الأنسجة الملوثة الطائرة على الوجه.			
6	على الكوادر الصحية تغطية الجروح باللاصق المقاوم للماء.			
7	التخلص الفوري والآمن من االادوات الحادة في الحاويات المخصصة			
8	يجب ملىء الحاويات المخصصة للادوات الحادة قبل التخلص منها *.			
9	يجب عدم إعادة غطاء الإبرة (السرنجة) قبل الرمي في الحاويات المخصصة للادوات الحادة*.			
10	التخلص من الأدوية/التجهيزات غير المستخدمة (المحاقن/المسحات) التي تؤخذ إلى محطة غسيل الكلى.			
11	العزل الكافي بين التجهيزات النظيفة والمواد والمعدات الملوثة.			
12	تنظيف وتطهير شامل للأسطح في محطة غسيل الكلى.			
13	فحص ماكنة غسيل الكلى بما في ذلك حماة المحول (transducer protectors) من التلوث بالدم.			
14	لا يلزم وجود ماكنة غسيل مخصصة للمرضى المصابين بفيروس التهاب الكبد C ، شريطة التقيد الصارم بإجراءات التنظيف والتطهير بين المرضى.			
15	يجب فحص حماة المحول الخارجي (External transducer protectors) على خطوط مراقبة ضغط دائرة الدم من قبل مقدمي العناية الصحية أثناء وبعد كل جلسة غسيل كلوي.			
16	يجب تنظيف وتعقيم آلة غسيل الكلى بداية كل يوم *.			
17	يمكن استخدام مكائن غسيل منفصلة للمرضى المعروف إصابتهم بفيروس التهاب الكبد B.			
18	يمكن استخدام مكائن غسيل التهاب الكبد الفيروسي B مرة أخرى للمرضى غير المصابين بعد تطهيرها.			

Appendix F: The questionnaire of the study

19	لا يمكن للعاملين الذين يعملون مع المرضى الذين يعانون من عدوى التهاب الكبد الفيروسي B ان يعملوا مع المرضى الذين لا يعانون من عدوى فيروس التهاب الكبد B في نفس الوقت.			
20	جميع المرضى الذين يبدأون غسيل الكلى أو العودة إلى غسيل الكلى بعد العلاج بطريقة أخرى يجب أن يكون فحص التهاب الكبد الفيروسي B معروفا سلبيًا قبل غسيل الكلى.			
21	فحص التهاب الكبد الفيروسي نوع C لجميع المرضى الذين يبدأون غسيل الكلى أو العودة إلى غسيل الكلى بعد طريقة أخرى للعلاج.			
22	يمكن فحص المناعة للمرضى الذين ليس لهم عوامل خطر محددة للاصابة بفيروس التهاب الكبد C.			
23	المرضى الذين يحتاجون إلى غسيل الكلى قبل أن تعرف نتيجة اختبار الفيروسات يجب أن يتم الغسل لهم خارج وحدة غسيل الكلى الرئيسية *.			
24	عند تحديد حالة جديدة من عدوى فيروس التهاب الكبد B ، ينبغي إحالة المريض المصاب إلى ألاخصائي للمزيد من التقييم والنظر في العلاج المضاد للفيروسات.			
25	يجب اختبار المرضى غير المستجيبين للفحص على الاقل كل 6 أشهر.			
26	يجب اجراء اختبار بشكل منتظم للأجسام المضادة للمرضى المصابين بالتهاب الكبد الفيروسي C الذين يُجرى لهم غسيل الكلى بالمستشفى كل 6 أشهر *.			
27	يجب مراعاة الاحتياطات الصحية التي تمنع بشكل فعال انتقال الدم أو السوائل الملوثة بالدم بين المرضى إما مباشرة أو عن طريق المعدات أو الأسطح الملوثة للسهولة.			
28	يجب مراجعة إجراءات التنظيف والتطهير عندما تكون هناك حالة جديدة من عدوى التهاب الكبد الفيروسي داخل وحدة غسيل الكلى.			
29	المرضى الذين لا يوافقون على اجراء فحص التهاب الكبد الفيروسي، يجب أن يكون غسيل الكلى في منطقة منفصلة ما لم تكن المناعة لالتهاب الكبد الفيروسي B معروفة للأشهر الستة السابقة.			
30	يجب أن يتم اجراء الغسل للمرضى المصابين بفيروس التهاب الكبد B في منطقة منفصلة عن وحدة غسيل الكلى الرئيسية.			
31	يحتاج المرضى المصابون بفيروس التهاب الكبد C إلى الغسيل في منطقة منفصلة ، مكافحة العدوى والالتزام بالاحتياطات العالمية بشكل صحيح *.			
32	يكون العاملون الصحيون أكثر عرضة للإصابة بعدوى فيروس التهاب الكبد C من الإصابة بفيروس التهاب الكبد B*.			
33	العاملون الصحيون الذين ليسوا محصنين ضد التهاب الكبد الفيروسي B وليسوا مصابين بفيروس التهاب الكبد B لا ينبغي أن يعملوا مع المرضى الذين هم مصابين بفيروس التهاب الكبد B*.			
33	يحتاج الموظفون المصابون حاديثا بالتهاب الكبد الفيروسي B إلى تصريح صحي مهني ورصد مستمر من أجل أداء واجباتهم السريرية.			

Appendix F: The questionnaire of the study

34	يجب تقييم جميع المرضى الذين يحتاجون إلى غسيل الكلى أو الزرع لعجزالكلى المزمن للعدوى الحالية أو السابقة بالتهاب الكبد B وتقديم التطعيم ضد الالتهاب إذا كان المرضى مصابين.			
35	يجب أن يتضمن الجدول الزمني الأولي للتحصين ضد فيروس التهاب الكبد B جرعات قليلة أو جرعات متكررة أو الإعداد المتاحة معا *.			
36	يتم إعطاء اللقاحات داخل العضل وفقا لمسارها المرخص (العضلات deltoid)*.			
37	مرضى غسيل الكلى المنتظم في المستشفى الذين يتم تطعيمهم التهاب الكبد الفيروسي Bيحتاجون فقط إلى اختبار فحص التهاب الكبد الفيروسي كل عام.			
38	المرضى الغير مستجيبين للفحص يجب أن يتم اختبارهم على الأقل كل 6 أشهر			
39	يجب تحصين اعضاء الكادر الذين لديهم اتصال سريري مع المرضى ضد فيروس التهاب الكبد الفيروسي B.			
40	يجب التخلص من قوارير (vials) الدواء بعد الاستخدام الفردي وتجنب القوارير (الفيالات)متعددة الإستخدامات.			
41	إذا تم استخدام قوارير الدواء (vials) لأكثر من مريض واحد ، يتم تقسيمها إلى جرعات متعددة وتوزيعها من منطقة مركزية.			
42	يمكن ثقب قوارير الأدوية الوريدية(vials) الموسومة للاستخدام الفردي أكثر من مرة *.			

Appendix G: List of experts

خبراء تحكيم استمارة الاستبيان

ت	اسم الخبير	سنوات الخدمة	مكان العمل	الشهادة	الاختصاص
1	ا.د. راجحة عبد الحسن حمزة	34	كلية التمريض/ جامعة الكوفة	دكتوراه	تمريض بالغين
2	ا.د. علي كريم الجبوري	25	كلية التمريض/ جامعة كربلاء	دكتوراه	تمريض صحة نفسية
3	ا.د. أمين عجيل ياسر الياسري	29	كلية التمريض/ جامعة بابل	دكتوراه	تمريض صحة مجتمع
4	ا.د حسين جاسم محمد	30	كلية التمريض/ جامعة بابل	دكتوراه	تمريض صحة مجتمع
5	ا.د حسين هادي عطية	30	كلية التمريض/ جامعة بغداد	دكتوراه	تمريض بالغين
6	ا.د سجاد سالم عيسى	24	كلية التمريض/ جامعة البصره	دكتوراه	طب اسره
7	أ.د ضرغام مجيد حميد	25	كلية التمريض/ جامعة المثنى	دكتوراه	تمريض بالغين
8	ا.م.د صلاح محمد صالح	30	كلية التمريض/ جامعة كركوك	دكتوراه	تمريض بالغين
9	ا.م.د شذى سعدي محمد	30	كلية التمريض/ جامعة بابل	دكتوراه	تمريض بالغين
10	ا.م.د خالدة محمد خضير	30	كلية التمريض/ جامعة بغداد	دكتوراه	تمريض بالغين
11	ا.م.د جمعه جبر عبدالرضا	20	كلية التمريض/ جامعة بغداد	دكتوراه	تمريض بالغين
12	ا.م.د صفاء الدين احمد	32	كلية الطب / جامعة البصره	دكتوراه	طبيب اختصاص باطنية
13	ا.م.د محمد يونس احمد	18	كلية الطب / جامعة البصره	دكتوراه	طبيب اختصاص باطنية

الخلاصة

دراسة وصفية مقطعية اجريت في وحدات الانفاذ الدموي في أربع محافظات في جنوب العراق (البصرة، ميسان، ذي قار، والمثنى) في الفترة من كانون الثاني 2019 إلى حزيران 2021.

تهدف الدراسة إلى تقييم معارف الممرضين فيما يتعلق بالتدابير والاحتياطات الوقائية لالتهاب الكبد الفيروسي سي و بي في وحدات الانفاذ الدموي، و المقارنة بين معارف الممرضين في المحافظات الأربعة.

اختيرت عينة غرضية شملت 96 من الممرضين العاملين في وحدات الانفاذ الدموي في المحافظات الجنوبية الاربعة. وقد جمعت البيانات باستخدام استبيان بني لهذا الغرض. ويتألف الاستبيان من خمسة مجالات تتضمن (42) فقرة و استخدمت تقنية المقابلة وجها لوجه كوسيلة لجمع البيانات.

تم تحديد مصداقية الاستبانة من قبل فريق من الخبراء مكون من (13) خبيرا, وثبات الاستبانة من خلال أستخدام اختبار معامل ألفا كرونباخ. و قام الباحث بتحليل البيانات من خلال استخدام اجراءات التحليل الاحصائي الوصفي(التكرار, والنسبة المؤوية) و الاستدلالي (المتوسط الحسابي, مربع كاي , اختبار أنوفا ذو الاتجاه الواحد و أختبار المقارنة البعدي (شيفي)).

وأظهرت نتائج الدراسة إلى أن الممرضين في وحدات الانفاذ الدموي في المحافظات الجنوبية الاربعة يتمتعون بمعرفة متوسطة فيما يتعلق بالتدابير والاحتياطات الوقائية لالتهاب الكبد الفيروسي بي و سي، وهناك اختلافات كبيرة بين معرفة الممرضين في وحدات الانفاذ الدموي في المحافظات الجنوبية الاربعة في العراق.

وخلصت الدراسة إلى أن أعلى نسبة من المرضى المصابين بالتهاب الكبد الفيروسي بي و سي في وحدة الانفاذ الدموي في محافظة البصرة، ونسبة أقل من المرضى المصابين في وحدة غسيل الكلى في محافظة المثنى. كما خلصت الدراسة إلى أن معرفة الممرضين تختلف بشكل كبير في وحدات غسيل الكلى في المحافظات الاربعة الجنوبية في العراق .

وأوصت الدراسة بتعيين الممرضين الذين لديهم أعلى المستويات التعليمية للعمل في وحدات الانفاذ الدموي، وينبغي وضع تعليمات خاصة على جدران وحدة الانفاذ الدموي، حيث يمكن لجميع الممرضين رؤيتها، مع تسليط الضوء على التدابير الوقائية الأساسية والاحتياطات لالتهاب الكبد الفيروسي سي و بي. كما أوصت الدراسة بنشر دليل تعليمات حول التدابير الوقائية

والاحتياطات ضد التهاب الكبد الفيروسي بي و سي واعطاءه للمرضى المصابين بالفشل الكلوي الذيعلى العلاج بالانفاذ الدموي.

جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة بابل
كلية التمريض

دراسة مقارنة لمعارف الممرضين المتعلقة بالتدابير الوقائية والاحتياطات من التهاب الكبد الفيروسي بي و سي في وحدات الانفاذ الدموي بين المحافظات الجنوبية من العراق

أطروحة مقدمه إلى

مجلـــس كلية التمريـــض، جامعه بابل كجزء من
متطلبات نيل درجة الدكتوراه فلسفة في علوم التمريض

تقدم بها
عبدالكريم سلمان خضير

بإشراف
أ.د فخرية جبر محيبس

ذي القعدة /1443 هجرية **حزيران/ 2021 ميلادية**