

A Knowledge, Attitude and Practices (KAP) analysis regarding Standard Precaution of infection control and impact of the knowledge and attitude of hemodialysis nurses on self-reported practices

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Abstract

Patients on hemodialysis are at risk of nosocomial infections can have a negative impact on mortality and place a costly strain on healthcare systems. In order to prevent the virus from spreading among patients, nurses must follow infection control protocols. **Aim:** This study aims to assess the current status of A Knowledge, Attitude and Practices (KAP) regarding infection control standard precautions among nurses who work in hemodialysis unit. **Materials and methods: Design:** A cross sectional descriptive design. **Setting and sample:** 37 nurses were recruited from hemodialysis unit at King Fahad General Hospital, Ministry of Health at Jeddah city. **Tools for data collection:** three tools were used including: Nurse's knowledge, attitude and practices questionnaire regarding standard infection control precaution among hemodialysis nurses. **Results:** less than half (45.9%) of nurses had a good knowledge regarding standard infection control precaution. The minority of nurses (24.3%) had a positive attitude. Slightly more than half of nurses (54.1%) in the study reported a good level of practice. There are significant differences in the overall level of knowledge were identified regarding the level of education also, the overall level of attitude showed significant differences by the age categories of participants, those nurses who aged 41 to 60 years. Also, the study reported positive and significant correlation between overall knowledge scale and overall practice scale. Moreover, overall attitude scale was significantly correlated with practice scale. **Recommendations:** designing training sessions and effective monitoring can improve their knowledge of standard infection control precautions in hemodialysis unit and is also expected to facilitate positive attitude and practice.

Keywords: Nurse's knowledge, Nurse's attitude, Nurse's practices, infection control, standard precautions, hemodialysis unit.

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I. INTRODUCTION

Hemodialysis (HD) is one of several renal replacement treatments (RRTs) used to remove excess fluids and waste products and restore chemical and electrolyte balances in patients with renal failure (Uoda, 2019). Hemodialysis is moving towards more novel procedures, biomaterials, and devices; however, every new treatment or technology must be backed up by good data (Shimokura et al., 2011; Shimokura, Weber, Miller, Wurtzel, & Alter, 2006).

Hemodialysis began as an external vascular circuit in which the patient's blood was pumped into polyethylene tubing and delivered to the dialysis filter or membrane (dialyzer) through a mechanical pump. The blood is then returned to the patient after passing through a semi-permeable membrane on one side of the dialyzer. The dialysate solution, which is made up of purified water and electrolytes, is pushed through the dialyzer in the opposite direction as blood flows through the semipermeable membrane. In most situations, systemic anticoagulation (with heparin) is administered to keep the hemodialysis circuit from clotting (Ahmad, Tan, Wu, & Beathard, 2021).

Patients on hemodialysis (HD) have a significantly higher risk of life-threatening infections. The majority of bloodstream infections are linked to vascular access, with a central venous catheter accounting for 70% of all infections (CVC) (Patel & Brinsley-Rainisch, 2018). Infections cause significant morbidity and are the second leading cause of death in people with end-stage renal failure, after only cardiovascular illnesses. Patients on HD are prone to viral infections such as hepatitis B (HBV), hepatitis C (HCV), HIV, and influenza, in

addition to bacterial infections. HCV outbreaks in HD facilities, which continue to occur with alarming regularity, are frequently the result of inadequate infection control methods (Nguyen et al., 2016).

Bloodstream infections have been linked to lapses in infection control methods such as hand hygiene and environmental cleaning. Several infection control methods, including hand cleanliness, proper catheter care, the use of antiseptic agents, checklists, and staff and patient education, are all strongly recommended by the CDC for minimizing infections (Mokrzycki et al., 2021). The CDC and other organizations, such as the Association for Professionals in Infection Control and Epidemiology, recommend that dialysis employees be properly trained on Standard Precautions and other infection control procedures (Faltas, 2018).

Standard Precautions are a set of precautions that should be followed in the care and treatment of all patients, regardless of whether they are infected with a disease or are suspected of being contaminated. Standard Precautions are meant to break the cycle of infection (Abdelwahab, Labah, Sayed, Elbedwey, & Gabr, 2019).

Hand hygiene is a significant step in preventing vascular access-related and viral infections, and dialysis facilities should make sure that handwashing facilities and alcohol-based hand sanitizers are readily available. Before handling a patient, (2) before aseptic procedures, (3) after bodily fluid exposure risk, (4) after touching a patient, and (5) after contacting patient surroundings are all opportunities for hand cleanliness. Staff training, hand hygiene, vascular access care audits, and staff feedback all resulted in a substantial reduction in access-related bloodstream infections in one quality improvement effort employing an evidence-based intervention package and CDC advice (Patel et al., 2013). Use of checklists and monthly audits of hand hygiene practices as well as feedback to the caregivers are strongly recommended to improve adherence (Vijayan & Boyce, 2018).

Infection control precautions must be integrated into the routine activities of the hospital and healthcare personals, nursing staff must take proper measures and follow suitable practices to significantly limit the risk of bloodborne infection being transmitted to patients and employees in dialysis units (Amira & Awobusuyi, 2014). In order to globalize and share the evidence, various evidence-based guidance has been published for the prevention of healthcare-associated infections (HAIs) in all HD settings, such as the Centers for Disease Control (CDC) recommendations, the Active Pharmaceutical Ingredients Committee (APIC) guide to the elimination of infections in HD (2010), and the Kidney Disease Improving Global Outcomes (KDIGO) Clinical Practice Guidelines, by the National Kidney Foundation (Lok et al., 2020).

After a patient dialysis session, all equipment, including the front of the dialysis machine, should be deemed polluted. To keep the hemodialysis circuit from clotting, systemic anticoagulation (with heparin) is administered (Novosad et al., 2019).

Hemodialysis nurses must be proficient in renal nursing, maintain a high quality of clinical practice, have strong communication skills, and grow their leadership and management talents (Gaietto & Brooks, 2019).

Nursing staff compliance with standard measures has been identified as an effective method of preventing and controlling health-care-associated illnesses. These precautions safeguard not only the patient, but also the nurses and the surroundings (Al Qahtani & Almetrek, 2017). Furthermore, nurses must have the clinical skills and competences to manage renal patients at various stages of disease and using various renal replacement therapy (RRT) modalities (Bouallègue et al., 2013). Many infection control strategies are simple and low-cost, but they involve employee responsibility and behavioral change, as well as improved staff education, reporting, and monitoring systems (Vijayan & Boyce, 2018).

1.1 Statement of the research problem

End-stage renal disease (ESRD), the last stage of chronic kidney disease (CKD) that affects 1/8 % of the world's population (Huang et al., 2019). It is defined as irreversible kidney function, and its incidence is rising every year. With over 1.4 million patients needing renal replacement treatment globally and over 1 million people dying each year, it has become a severe public health concern (Alkhlaif, Alsuraimi, & Bawazir, 2020).

Due to enormous and rapid changes in lifestyle, high population growth, rapid increase in life expectancy, and massive urbanization over the last three decades, the Kingdom of Saudi Arabia (KSA) has seen a marked increase in the prevalence and incidence of ESRD; this rise exceeds that reported in many other countries (Abdulla A & Faissal A, 2011).

1.2 Significance of the Research

Health-care associated infections (HAIs) considered one of the serious problems that face healthcare providers while handling patients' services. Those infections are common causes of morbidity and mortality among hospitalized patients (Al-Faouri, Okour, Alakour, & Alrabadi, 2021). According to the Center for Disease Control and Prevention in 2011, standard precautions were defined as "the minimum infection prevention

measures that should be applied to all patient care” regardless of their suspicion or confirmation of infection status of the patients, which are used in any setting where health care is delivered(Wahab & Adie, 2021).

Nurses and patients are exposed to various types of infections during their clinical practice. Knowledge and compliance with standard precautions are essential to prevent hospitals associated infections and protect patients as well as medical workers from exposure to infectious agents(Brown, 2019).

Nurses should have professional and ethical obligations to ensure that their infection control knowledge and skills are current, and that they practice safely and professionally at all times(Faltas, 2018).Renal nurses must be proficient in renal nursing, maintain a high quality of clinical practice, have strong communication skills, and grow their leadership and management talents.Nurses should be included in multi-professional meetings when decisions about changes in patient treatment are made. Nurses also need clinical skills and competences to care renal patients at various stages of disease and using different RRT modalities(Uoda, 2019).

1.3 Aim of the research

The present study aims to assess the current status of A Knowledge, Attitude and Practices (KAP) regarding infection control standard precautions among nurses who work in hemodialysis unit in King Fahad General Hospital, Jeddah City, KSA.

1.4 Objectives

The aim of this study is to assess the nurses' knowledge, Attitude and practices regarding infection control standard precautions among nurses who work in hemodialysis unit, King Fahad General Hospital in Jeddah city through the following objectives:

- Assess hemodialysis nurses' knowledge regarding infection control standard precautions in King Fahad General Hospital in Jeddah city.
- Assess hemodialysis nurses' attitude regarding infection control standard precautions in King Fahad General Hospital in Jeddah city.
- Assess hemodialysis nurses' practices regarding infection control standard precautions in King Fahad General Hospital in Jeddah city.
- Find the relationship between nurses' knowledge, attitude and practices regarding infection control standard precautions among hemodialysis nurses in King Fahad General Hospital in Jeddah city.

1.5 Study questions

- What is the level of hemodialysis nurses' knowledge regarding infection control standard precautions in King Fahad General Hospital in Jeddah city?
- What is the hemodialysis nurses' attitude regarding infection control standard precautions in King Fahad General Hospital in Jeddah city?
- What is the level of hemodialysis nurses' practices regarding infection control standard precautions in King Fahad General Hospital in Jeddah city?
- What is the relationship between nurses' knowledge, attitude and practices regarding infection control standard precautions among hemodialysis nurses King Fahad General Hospital in Jeddah city?

1.5 Operational definition:

- *Hemodialysis (HD)*: it is process of removing blood from a patient whose kidney functioning is faulty, purifying that blood by dialysis, and returning it to the patient's bloodstream.
- *Knowledge*: It refers to the nurses' information regarding stander precaution in infection control or ideas that gained through observation or experience of education.
- *Practice*: is the act of an activity or skills so as to acquire or maintain proficiency in it.
- *Attitude*: the way you think and feel about someone or something it can be positive/negative attitude about the changes.
- *Nurses*: are people who provide services essential to or helpful in the promotion, maintenance and restoration of health and well-being.
- *Standard Precautions*: are the minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered.
- *Infection control*: to prevents or stops the spread of infections in healthcare settings.
- *Self-reported practices*: any method which involves asking a participant about their feelings, attitudes, beliefs and so on.

1.6 Theoretical framework

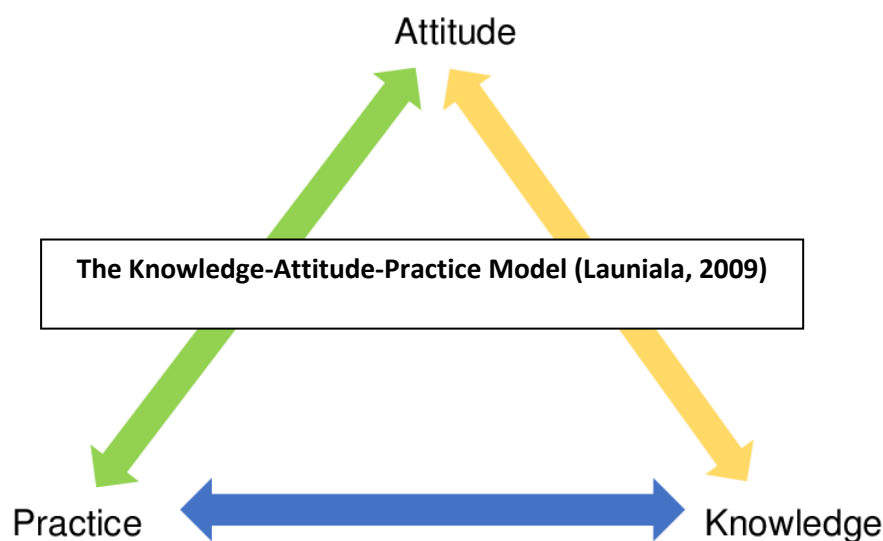
This part explains the methods and materials that will be used to achieve the research aim. It includes research design, study setting, population and sampling method, data collection tools and method of data collection, and

analysis methods, and finally ethical considerations and timetable. The conceptual framework that will be used in this study is designed as a knowledge, Attitudes and Practices (KAP). (KAP) studies explore the knowledge, attitude and practices of an any community (Kaliyaperumal 2004). KAP studies disclose to us what individuals think about specific things. how they feel and furthermore how they act. KAP studies can also recognize knowledge gaps. Cultural beliefs, or behavioral designs that may encourage understanding and action. They can recognize factors that influencing one's behavioral conduct that is not known to other individuals. the reasons behind these attitudes, and how and why persons adapt these attitudes. The main purpose of this KAP study is to explore knowledge, attitude and practices of the nurses regarding infection control standard precautions among nurses who work in hemodialysis unit.

The research using Knowledge, Attitudes and Practice (KAP) model. It can be used to assess knowledge, attitudes and practices among nurses. The present study designed to examine the knowledge and practices from KAP among professionals' nurses.

According to the KAP Model (Launiala, 2009), there are interrelations among knowledge, attitude, and practice. Certain knowledge can influence individuals' ability to perform actions. The attitude affects individual towards practice. Knowledge and attitude bring changes in human behavior. Therefore, integral elements of knowledge, attitude, and practice represent the standard of nursing practice.

The KAP model will be used to measure what nurses know about stander precaution of infection control. Attitude instruments measure the feelings and beliefs of participants about the phenomena, and information on practice measures the behaviors that individuals follow to avoid hemodialysis. The researcher chooses a sample of participants that is representative of the population worked in King Fahad General Hospital (KFGH) specifically in hemodialysis unit.



II. REVIEW OF RELEVANT LITERATURE

History of Stander Precaution and Infection Control

Universal precautions refer to the practice, in medicine, of avoiding contact with patients' bodily fluids, by means of the wearing of nonporous articles such as medical gloves, goggles, and face shields. The infection control techniques were essentially good hygiene habits, such as hand washing and the use of gloves and other barriers, the correct handling of hypodermic needles, scalpels, and aseptic techniques. Following the AIDS outbreak in the 1980s the US CDC formally introduced them in 1985–88. Every patient was treated as if infected and therefore precautions were taken to minimize risk (CDC, 1988).

In 1987, the practice of universal precautions was adjusted by a set of rules known as body substance isolation. In 1996, both practices were replaced by the latest approach known as standard precautions. Use of personal protective equipment is now recommended in all health care settings (Lam, 2011).

What is Stander Precaution and Infection Control

Standard precautions are a set of preventative measures used to avoid the spread of infectious illnesses that are transmitted by blood (Asmr et al., 2019). Standard precaution against blood borne pathogens refers to infection

control techniques to pathogenic microorganism that are present in human blood and can cause disease in humans (Nwovu, Ifeanyi, Uzoma, & Nwebonyi, 2018).

Hand hygiene, the use of Personal Protective Equipment [PPE], safe injection techniques, the safe handling and cleaning of contaminated equipment, and respiratory hygiene/cough etiquette are all included. Hand hygiene is the simplest, most cost-effective, and most critical action for avoiding infection in the hospital setting(Almoghrabi et al., 2018).

Importance of Stander Precaution and Infection Control

Compliance with standard precautions by health-care personnel, specifically nursing staff, has been identified as an effective way to prevent and control health-care-associated infections in hemodialyzed patients. Patients, health-care professionals, and the environment are all protected by such procedures(Bagheban Karimi, Lakdizaji, Zamanzadeh, & Hasankhani, 2018).

The term "needle stick injury" refers to any harm produced by hollow-bore needles or suture needles, regardless of whether they have been contaminated with blood or other bodily fluids(Dulon, Stranzinger, Wendeler, & Nienhaus, 2020). According to the World Health Organization [WHO] (2015), a person who gets one NSI from a needle used on an infected patient has a 30%, 1.8 percent, and 0.3 percent chance of contracting HBV, HCV, and HIV, respectively(Garus-Pakowska & Górajski, 2019).

Jacob, Newson-Smith, Murphy, Steiner, and Dick(2010) conducted an exploratory research in the United Arab Emirates and discovered that 19% of the respondents suffered sharp injury(Maitanmi, Abdulkareem, Maitanmi, Ogungbesan, & Onisile, 2020). PPE refers to a range of barriers that an employee might use alone or in combination to prevent their exposure to blood-borne diseases(Smoot, 2021).Another component of standard precaution is safe injection procedure, which includes not harming the receiver, not putting the provider at risk, and avoiding waste that is harmful to the community(Price et al., 2019). Standard Precautions must be followed in order to improve the safety environment in health-care settings(Oh & Choi, 2019).

Several studies have discovered a link between improving standard precautions and decreasing infection occurrences(Yasmeen et al., 2022). According to a research conducted in Spain, the impact of hand cleanliness on infection reduction is predicted to be 50%(Azor-Martinez et al., 2020).Jacob, Newson-Smith, Murphy, Steiner, and Dick (2010) conducted an exploratory research in the United Arab Emirates and discovered that poor compliance with basic precautions doubled the risk factor for sharp injuries. (Maitanmi et al., 2020).

The delivery of healthcare has always been connected with the risk of a variety of patient safety. Healthcare associated infection (HCAI), also known as hospital acquired infection or nosocomial infection, is one of the most important and relevant concerns in hospital healthcare delivery

It is widely recognized that implementing infection control measures consistently and rigorously lowers the rate of nosocomial infections significantly. Interventions to increase infection control policy adherence might lower the frequency of these infections, allowing more resources to be directed to other areas of healthcare delivery. Despite the fact that evidence-based methods supporting suitable behaviours are widely publicized, it has been repeatedly demonstrated in numerous settings that compliance with conventional infection control measures is sub-optimal(Al Qahtani & Almetrek, 2017).

Principle of Infection Control

Standard precautions include hand hygiene, the use of appropriate personal protective equipment (PPE), the use of aseptic technique to prevent patient exposure to pathogens, and the handling of sharps, blood spills, linen, and garbage to keep the environment safe(Mikulska, 2019).

Universal precautions, often known as standard precautions, are one of the basic concepts of infection prevention. These guidelines are based on risk assessments and incorporate common sense and personal protective equipment (PPE). In all patient care settings and healthcare educational settings, standard safeguards are used. The goal of universal precautions is to keep students, employees, and healthcare professionals (HCPs) safe from infection, as well as to keep a patient population safe from infection(Nulens, Gonzalo Bearman, & Fshea, 2018).

The concept of healthcare-associated infections broadens the scope of the previously developed concept of hospital-acquired infections(Manoukian et al., 2021). Infection control principles can be summarized as follows: overcoming resistant and preventing the spread of illness In order to effectively manage infection management, one must understand the relevant mode(s) of transmission, proper precautions, hand hygiene, and the concepts of incidence, disinfection, sterilization, and resistance(Yoo, 2018).

Despite the fact that infectious disease management originated as a system adopted by each medical institution, it is evolving into a networked system as a result of increased efficiency, extensive information exchange, and the need for consistent rules (Bloom & Cadarette, 2019). Therefore, infectious disease management is expected to be integrated into the foundation of public and private partnerships in the future(Yoo, 2018). In particular, since science and technology are developing exponentially, with innovations emerging on a daily basis, it is necessary for workers in the infection control management field to actively engage with rapidly changing trends.

The two goals of standard precautions are to lower the risk of contracting an occupational infection. First, to avoid percutaneous damage to healthcare personnel, and second, to prevent infection transmission. Regardless of their diagnosis or suspected infectious status, all patients in health-care settings are treated with standard precautions. Effective hand hygiene, proper waste disposal, and the use of personal protection equipment are all examples of these measures. However, noncompliance has been widely documented across the world (El-Greeb, Amel, Hussien, & Samia, 2018).

Obstacles of non-compliance on standard precautions and infection control measures

Infection prevention policies are not followed, putting healthcare staff, patients, and communities at risk. Despite the rise in highly infectious illnesses, many poor nations lack infection prevention policies among healthcare staff. For the prevention and management of nosocomial infections, it is critical to understand infection prevention techniques (Sahiledengle, Gebresilassie, Getahun, & Hiko, 2018).

Many researchers focused on the factors that contribute to non-compliance with Standard Precautions. Reported factors were lack of knowledge (Alshammari et al., 2018; McCauley, Kirwan, & Matthews, 2021). Lack of time (Efstathiou, Papastavrou, Raftopoulos, & Merkouris, 2011), forgetfulness, lack of means, negative influence of the equipment on nursing skills, uncomfortable equipment, skin irritation (Kim & Oh, 2015), lack of training (El-Greeb et al., 2018).

Finally, the application of clear precautions and infection control measures should be mandatory to set standards for health care delivery in the country, to ensure that all health care providers adhere to all these precautions while providing health services.

Theoretical framework

The theoretical framework that applies to this study is the knowledge, attitude and practice model (KAP).

Rogers proposed DOI theory (diffusion of innovation) in 1962. This theory tries to describe the process that new ideas spread over time. The theory studies are highly focused evaluations that measure changes in human knowledge, attitude and practice in response to a specific intervention.

it consists of features such as, the spreading occurs because of the passing of time, and that most people will experience the usage, not the adoption of an innovation. In recent years the innovation diffusion theory has been integrated into three stages: knowledge, attitude and practice. KAP model is a quantitative method to provide access to quantitative and qualitative information. It reveals misconceptions that may represent obstacles to the activities that we would like to implement or potential barriers to behaviour change.

A KAP can measure the extent of a known situation, confirm or disprove a hypothesis; provide new tangents of a situation's reality. It also suggests an intervention strategy that reflects specific local circumstances and the cultural factors that influence them and plan activities that are suited to the respective population involved (Hubbard and Hayashi 2013).

RELEVANCE OF KAP MODEL TO THE STUDY

The learning knowledge of the nurse affects her learning attitude, while learning attitude affects, and is shown, through the learner's behaviour. On the other hand, it also enhances the knowledge, attitude and practices of specific themes, and identifies what is known and done about various health related subjects. KAP model establishes the baseline for use in future assessments and help measure the effectiveness of health education activity's ability to change health related behaviours.

It has been employed in the nursing field from 1960s to teaching nurses how to improve their techniques in practice, the cognitive learning was focused on the knowledge and ability of realization, the affective learning means to change subject's intention, attitude or norms to adjust themselves through hygiene education. Psychomotor learning requires nurses to learn some skills compared which practice which required the changing of behaviour as target.

Conventional thinking in the field of health is that knowledge affects the nurse's attitude directly, and the attitude is transformed into behaviour. Xie (2013) discovers in her research that if nurses have a higher level of knowledge, her learning attitude is relatively more positive. Other related studies find that knowledge will directly affect the attitude and practice, and that attitude will directly affect the practice or intentions, except that the degree of impacts that knowledge affects practice through attitude is better than that of knowledge affects practice directly. Therefore, this work uses KAP framework as a base to develop the required assessment tool.

The researcher found that the KAP model will help nurses to utilise their knowledge of stander precaution and infection control. In other to carry this out, their attitude towards safe application of stander precautions in their work while performing haemodialysis procedure. Since their attitude is being transformed into their behaviour, assessing nurses' attitude will determine how effective and efficient they practice stander precaution and infection control measures.

Empirical studies

Ogoina et al., (2015), study to describes the knowledge, attitude and practice (KAP) of standard precautions of infection control among health care worker (HCW) of two tertiary hospitals in Nigeria, by using structured self-administered questionnaire assessing core elements of KAP of standard precautions, among 290 health care

workers participated in the study, the majority of participants was nurses. The result shows participants' knowledge and attitude scores toward standard precautions were above 90%, but median practice score was 50.8%. The majority of the HCW had poor knowledge of injection safety and complained of inadequate resources to practice standard precautions. Junior nurses had lower knowledge and compliance with standard precautions than more experienced nurses.

While other study was done by Ginny Kaushal et al in (2015), aimed to analyze knowledge, attitude and practice of nurses who work in intensive care units in a tertiary care hospital by using survey research which has used a self-administered questionnaire to compare the KAP of nursing professionals of an ICU in a tertiary care hospital. Result shows participants had an average level of knowledge (79%), good attitude (89%) toward infection control guidelines and very good self-reported practices (91%). The collective KAP score of all the participants is good (85%) which indicates that average levels of knowledge are balanced by good attitude and very good practices. Also, it shows that there is a significant impact of knowledge and attitudes of critical care nurses on their self-reported practices.

As revealed by study done in China and Ethiopia, to describe and compare the Knowledge, Attitudes and Practices pertaining to standard precautions among nurses, 357 nurses, the result shows both Ethiopian and Chinese nurses showed favorable attitudes towards standard precautions, however, Chinese nurses reported better knowledge and practices. The study suggests the organization should strengthen formal and on-the-job training, implement targeted infection prevention strategies and provide adequate medical supplies to improve infection control in Ethiopia (Zhu, Kahsay, & Gui, 2019).

Lobo D et al (2019), carried out a study at A. J. Hospital and Research Center, Mangaluru, to describe health workers' knowledge and practice compliance and attitude regarding infection control measures among health care workers. The results show majority of nurses had an average knowledge and practice, positive attitude about infection control. Therefore, it is necessary that staff nurses should be trained about the prevention of hospital-acquired infection based on successful educational models, knowledge and practice suggests knowledge does not always translate into good practice. Lack of resources, excess workload and time constraint have been reported as major factors influencing the poor practice of infection control in healthcare facilities.

A study carried out in Batticaloa, Sri Lanka, on standard precautions to assess the knowledge, attitude and practice of nurses about standard precautions, among 367 nurses, the result shows only 13.4% of participants received training on standard precautions while 3.3% of participants were unaware about standard precautions. Most of the participants (53.1%) had heard of standard precautions mainly from infection control unit while 21.8% learned from own experience. Among the participants 73.8% had good knowledge, 56.4% had an average attitude and 94.6% had good practice. Knowledge score was significantly associated with place of work and work experience. The study suggests to include educational programs concerning various aspects of standard precautions should be implemented. Appropriate provision of safety utilities is recommended to strengthen knowledge, alter attitude and enhance adherence of nursing professionals to standard precautions (Samarasinghe, Maithreepala, Rangana, & Thanis, 2020).

III. RESEARCH METHODOLOGY

Materials and Methods

This chapter provides description of material and methods used to conduct this study which includes: research design, setting, sample, tools for data collection, validity and reliability of tools, data collection process, data statistical analysis and ethical consideration. Research methodology is an organized, systematic, data-based, critical, objective, scientific inquiry or investigation into a specific problem undertaken with the purpose of finding answers or solutions to it (Goundar, 2012).

The present study aims to assess the nurses' knowledge, attitude and practices regarding infection control standard precautions among nurses who work in hemodialysis unit in King Fahad General Hospital, Jeddah City, Saudi Arabia, through the following objectives: Assess hemodialysis nurses' knowledge regarding infection control standard precautions in King Fahad General Hospital in Jeddah city, to assess hemodialysis nurses' attitude regarding infection control standard precautions in King Fahad General Hospital in Jeddah city, also, to assess hemodialysis nurses' practices regarding infection control standard precautions in King Fahad General Hospital in Jeddah city and to find the relationship between nurses' knowledge, attitude and practices regarding infection control standard precautions among hemodialysis nurses in King Fahad General Hospital in Jeddah city.

Materials

Research Design

Cross-sectional descriptive design was used to conduct the present study and to answer the research question. A cross-sectional study is a form of observational study in medical research and social science that examines data from a given population or representative subset at a specific point in time (Crowder, 2017). The descriptive design helps to describes the characteristics of a situation or phenomenon in a population that is being studied (Wang, 2015).

Study Setting

The current study was conducted in hemodialysis unit at King Fahad General Hospital, Ministry of Health at Jeddah city which is located in the Western Region of Saudi Arabia from July 2022 to September 2022.

Sample Size

A Convenience sample of were recruited from hemodialysis department in King Fahad General Hospital according to the inclusion criteria. The total number of nurses staff who work in Hemodialysis unit was 46 nurses. If the margin of error is 5%, the confidence level is 95%. The sample size was 42 nurses calculated according to Raosoft application.

Tools for data collection:

In order to fulfil the aim of this study, the researcher was use three tools for data collection:

Tool 1: Nurse`s knowledge questionnaire on infection control standard precautions.

it will include two parts.

Part 1: Demographic characteristics for nurses:

Demographic data will be consisting of age, gender, working experience, educational level for the participants and professional information as exposed to infection while working & Received training on infection control.

Part 2: Nurse`s knowledge questionnaire regarding infection control standard precautions.

This tool adapted and will be modified from (Abalkhail et al., 2021). It is in the English language structured questioner to assess nurses` knowledge in on infection control standard precautions, it consists of 20 items will be used to assess the nurses' knowledge regarding infection control standard precautions.

The scoring procedure for nurses` knowledge will be interpreted as follows: for all a 20 item-scale. We will provide 1 point for each right answer and 0 point for each wrong answer. The maximum possible score was 20 points with a range from 0 – 20 points. Overall level of knowledge will be classified as:

- Poor (<10 points, <50% right answer).
- Moderate (10 – 15 points, 50 – 79% right answer).
- Good (16 – 20 points, 80 – 100% right answer).

The total result will be categorized into two groups - good (16 – 20 points, 80 – 100% right answers) and moderate to poor (<16 points, <80% right answers).

Tool II: Attitude of hemodialysis nurses towards standard infection control precautions Questioner

This tool adapted and will be modified from (Abalkhail et al., 2021). Which includes 14-item scale designed to measure participants` attitudes towards standard infection control precautions. The tool has a 5-point Likert scale. This was used to represent people's attitudes to a topic scored on 5-point scale, 1 (Strongly Disagree), 2 (Disagree), 3 (Uncertain), 4 (Agree) to 5 (Strongly Agree).

The scoring procedure for nurses` Attitude will be interpreted as follows: The maximum possible score was 70 points with a range from 14 – 70 points. Attitudes were classified as poor (<35 points), moderate (35 – 55 points) and positive (56 – 70 point).

Attitude will be classified into two groups:

- Positive (56 – 70 points, 80 – 100% score).
- Poor to moderate (<56 points, <80% score).

Tool II: Practice of standard infection control precaution among hemodialysis nurses Questioner

This part will assess nurses practice regarding infection control standard precautions using 15 questions on practicing standard precautions. Participants were given 1 point for each activity they were always practicing and 0 point for not practicing. The maximum possible score was 15 points with a range from 0 – 15 points.

Overall level of practice will be classified as:

- Poor (<8 points).
- Moderate (8 – 11 points).
- Good (12 – 15 points).

Nurses` practices will be classified into two groups:

- Good (12 – 15 points).
- Moderate to poor (<12 points).

Methods

Written Approval

An official letter from Directorate of Health Affairs in Jeddah was obtained prior to study conduction to take their approval to collect the data. [IRP Log No: A01371]. Permission to carry out the study was taken from King Fahad General Hospital, Jeddah kidney center (JKC) after explanation of the aim of the study.

Ethical Consideration

After obtaining the official permission from the Directorate of Health Affairs to conduct the study, the researcher started the process of data collection. Written informed consents to participate in the study were obtained from the participants after explanation of the aim of the study. The researcher affirmed to the administration authorities that; the conduction of the study will not affect the employee. Also, the anonymity, confidentiality, privacy and right to refuse were assured for all participants.

Tools validity & reliability

Reliability test had been performed for all study questionnaires to test the internal consistency using Alpha Cronbach test. Firstly, Nurse's knowledge questionnaire on infection control standard precaution's reliability test for the internal consistency was 0.719 Cronbach Alpha or 71.9% indicating a high internal consistency. Secondly, Attitude of hemodialysis nurses towards standard infection control precautions questionnaire reliability analysis was 0.850 Cronbach Alpha or 85.0% which indicates high internal consistency, finally, practice of standard infection control precaution among hemodialysis nurse's questionnaire reliability analysis was 0.850 Cronbach Alpha or 85.0% which indicates high internal consistency.

Pilot study

A pilot study was conducted on 10% of total number of nurses who work in hemodialysis unit (4 participants) to clarify the validity of the questionnaires and to test the research feasibility, clarity, internal consistency and objectivity of the tools as well as to estimate the time needed for data collection. The pilot study was performed in June 2022. There were minor modifications done to the questionnaires according to the jury feedback, so the sample of the pilot study was excluded from the study sample.

Data collection Process

After obtaining the administrative approval to conduct the study and contacting the research affairs in King Fahad General Hospital, the data was collected four hours per day, five days per week in morning shift for three months. The available nurses in hemodialysis unit were recruited. Then, nurses' written consents were obtained after explaining the aim of the study and assuring the confidentiality and anonymity, as well as their right to refuse and withdraw from the study at any time. There are 2 nurses were excluded due to they were in materiality leave at time of data collection.

The nurses were given the knowledge questionnaires during their presence in hemodialysis unit or the meeting room between or after the client visit to fill up demographic characteristic and answer the question in the presence of the researcher. The questionnaires needed approximately 30 – 40 minutes to be filled up. The researcher was the only person distributing and responding to nurses' inquiry. The researcher reviewed each collected questionnaire to assure its completeness and if there is any missing data.

The data was collected by the researcher over three months, started from the beginning of July 2022 to the end of September 2022. Finally, the collected data was kept in locked locker and it will be destroyed after one year.

Data Analysis

In order to analyse the data, the researcher will be using Statistical Package for Social Science (SPSS) version 25.0 will be used during the data analysis step. Categorical variables were presented in frequencies and percentages, while the quantitative scale variables were presented in means and standard deviations. The differences in overall scales by the basic demographic characteristics of nurses were tested using nonparametric analysis. Two tests were used, Man Whitney and Kruskal Wallis tests. A p value of 0.05 or less were set to be significant.

IV. RESULTS

Part I: Demographic & work-related characteristics of the nurses in hemodialysis unit:

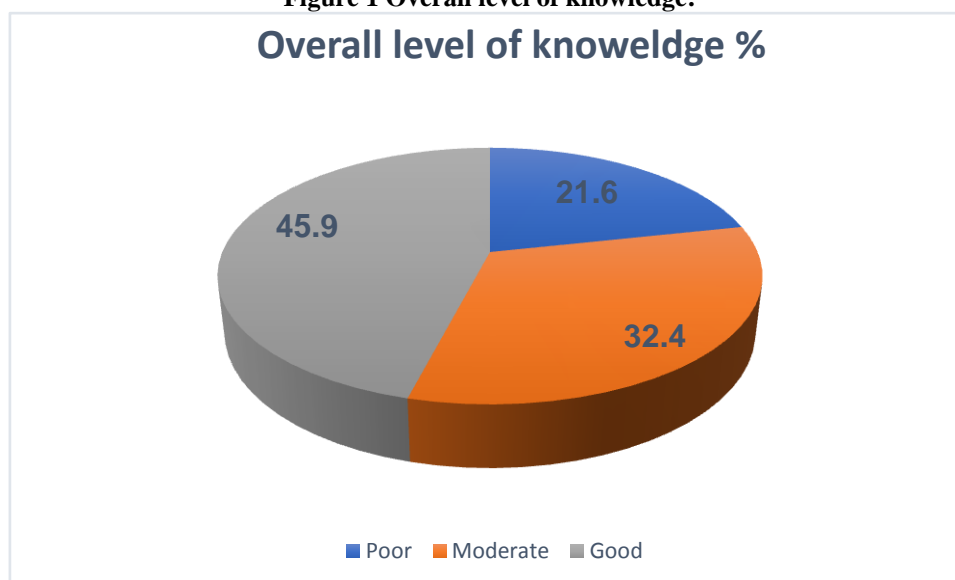
Table 1: Basic characteristics of participants:

Variable	N=37
Age	
25-30	4 (10.8)
31-35	11 (29.7)
36-40	12 (32.4)
41-60	10 (27.0)
Gender	
Female	37 (100)
Level of education	
Diploma	28 (75.7)
Bachelor	9 (24.3)
Experience years	
1-5	3 (8.1)
6-10	8 (21.6)
11-15	11 (29.7)
16+	15 (40.5)
Exposure to infection	
No	8 (21.6)
Yes	29 (78.4)
Training on infection control	
No	7 (18.9)
Yes	30 (81.1)

Table 1 presented the basic demographic characteristics of respondents, out of the 37 participants, (32.4%) were aged 36 to 40 years. All participants were female nurses, with majority had diploma level of education (75.7%). More than 40% of participants had working experience of 16 and above years. Most of respondents were exposed to infection during the work (78.4%), and (81.1%) of them had a training on the infection control.

Part II: level of nurses' knowledge regarding infection control standard precautions among nurses who work in hemodialysis unit.

Figure 1 Overall level of knowledge:



The overall level of knowledge of hemodialysis infection control standard was depicted in figure 1, the majority (45.9%) of nurses had a good knowledge, while (21.6%) of them showed a poor level of knowledge.

Table 2 Knowledge of hemodialysis nurses on infection control standard precautions:

Item	Correct responses n (%)
Standard precautions are used for the care of hemodialyzed patients regardless of their diagnosis and perceived infection status.	35 (94.6)
Isolation precaution is one of the elements in standard precaution.	33 (89.2)
Washing hands after contact with the hemodialyzed patient's environment is one of the elements in standard precaution.	32 (86.5)
Alcohol-based rubs are used after removing gloves.	26 (70.3)
Performing hand hygiene is required before and after hemodialyzed patient's care.	27 (73.0)
Hands should be washed with soap and water before and after handling potentially infectious materials irrespective of wearing gloves.	26 (70.3)
PPE is important in infection control because acts as a barrier between infectious materials such as viral and bacterial contaminants and your skin, mouth, nose, or eyes (mucous membranes).	24 (64.9)
Gloves must be worn every time during handling potentially infectious materials.	25 (67.6)
Gloves must be changed during patient care if you move hands from 'contaminated body site' to 'clean body site'.	25 (67.6)
Surgical masks can protect the nose and mouth when procedures and activities are likely to generate splashes or sprays of blood and body fluids.	20 (54.1)
The purpose of using a gown or apron is to protect clothes from splashes or sprays of blood and body fluids.	28 (75.7)
Removed all personal protective equipment (PPE) before leaving the patient's environment.	30 (81.1)
Stationary, telephones kept in wards, and doorknobs can be sources of infections.	30 (81.1)
All linen from an infectious patient should be thrown in a red linen bag even when it is free from visible blood or body fluids.	18 (48.6)
Segregation of clinical and non-clinical waste is important for preventing spread of infection.	23 (62.2)
Ampoules injection that has been used must be disposed of in the clinical waste bin.	19 (51.4)
Recapping of needles, in general, is not appropriate.	21 (56.8)
If you puncture hand with sharp instruments, you must report to the concerned authorities.	24 (64.9)
Puncture-proof containers should be used for disposal of sharps objects.	22 (59.5)
Mask must be placed on coughing patients to prevent potential dissemination of infectious respiratory secretions from the patient to others.	23 (62.2)
Overall	13.8 ± 4.6

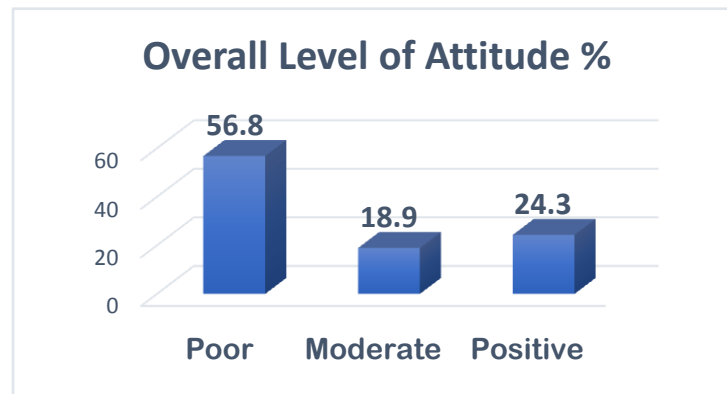
The frequency and percentage of correct answers of knowledge scale presented in table 2, the highest percentages of correct answers were found in the items related to Standard precautions are used for the care of hemodialyzed patients regardless of their diagnosis and perceived infection status (94.6%), Isolation precaution is one of the elements in standard precaution (89.2%), and Washing hands after contact with the hemodialyzed patient's environment is one of the elements in standard precaution (86.5). The lowest percentage of correct answers was reported in the item related to All linen from an infectious patient should be thrown in a red linen bag even when it is free from visible blood or body fluids (48.6%). Overall, the mean of scale was 13.8 correct answers with 4.6 SD.

Part III: level of nurses' Attitude regarding infection control standard precautions among nurses who work in hemodialysis unit.

Table 3 Attitude of hemodialysis nurses towards standard infection control precautions:

Item	Positive n (%)
Standard precaution is not easy to follow.	21 (56.8)
Standard precautions prevent the spread of infections from patients to HCWs and vice versa.	18 (48.6)
Infectious diseases can be treated hence PPE are not required.	13 (35.1)
Prefers to perform hand hygiene before and after any intervention with patients.	20 (54.1)
PPE can be used during emergencies.	14 (37.8)
Changing gloves is not necessary during procedures even if heavily contaminated.	16 (43.2)
It is difficult to work wearing PPE.	15 (40.5)
Healthcare providers should ensure the availability of adequate protective barriers.	11 (29.7)
HCWs should not use PPE because it may harm patients psychologically.	17 (45.9)
Stationeries, telephones, and doorknobs are not sources of infections.	17 (45.9)
Segregation of clinical and non-clinical waste is useful to prevent transmission of infections from one to another.	14 (37.8)
Adequate disinfection of medical equipment should be ensured by all HCWs.	15 (40.5)
Transmission of infectious organisms can be reduced by adhering to standard and contact precaution.	16 (43.2)
It is not logical to assume all patients contagious unless their infection has been confirmed.	11 (29.7)
Overall	29.5 ± 26.0

Figure 2 Overall level of attitude:



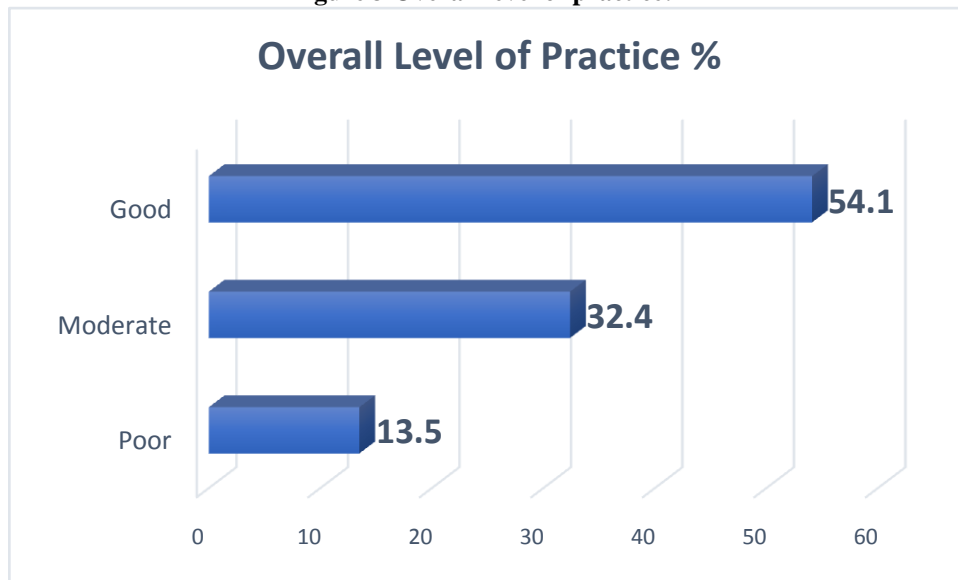
The overall distribution of level of attitude scale showed a high percentage of poor attitude among participants (56.8%), only 24.3% of nurses were found to have a positive attitude (figure 2). The distribution positive attitude by item reported that the highest positive attitude was related to the items of Standard precaution is not easy to follow (56.8), while the lowest positive attitude was related to the items of It is not logical to assume all patients contagious unless their infection has been confirmed (29.7).

Part IV: level of nurses' Practice regarding infection control standard precautions among nurses who work in hemodialysis unit.

Table 4 Practice of standard infection control precaution among hemodialysis nurses:

Item	Good practice n (%)
Always performs hand hygiene when comes in contact with patients.	33 (89.2)
Always performs hand hygiene after taking off gloves.	33 (89.2)
Always washes hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances.	33 (89.2)
Always wears gloves when drawing blood samples.	33 (89.2)
Always wears gloves when disposing of stool or urine.	29 (78.4)
Always wears gloves when handling impaired patient-skin.	28 (75.7)
Always wears gloves when handling the patient's mucosa.	26 (70.3)
Always wears gloves when handling saliva or sputum culture.	30 (80.1)
Always wears gloves when performing parenteral injections of medications.	23 (62.2)
Always wears gloves when dressing wounds.	26 (70.3)
Always wears gloves when comes in contact with blood.	26 (70.3)
Always wears mask when performing operations/ procedures that might induce spraying of blood, body fluid, secretions, or excretions.	25 (67.7)
Always wears protective eye patch or goggle when performing operations/procedures that might induce spraying of blood, body fluid, secretions, or excretions.	25 (67.7)
Always wears protective suits or gown when performing operations/procedures that might induce spraying of blood, body fluid, secretions, or excretions.	23 (62.2)
Always dispose of needles, blades or any other single use sharp objects in a sharp disposal container after use.	24 (46.9)
Overall	11.3 ± 3.0

Figure 3 Overall level of practice:



Overall, more than half of nurses included in the study reported a good level of practice (54.1%), the percentage of low practice level was found to be 13.5%. High percentages of good practice were reported in the items related to always performs hand hygiene when comes in contact with patients, always performs hand hygiene after taking off gloves, always washes hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances, and always wears gloves when drawing blood samples (89.2%). The lowest percentage of good practice was found to be related to the item of always dispose of needles, blades or any other single use sharp objects in a sharp disposal container after use (46.9%).

Part V: Relation between demographic characteristics and nurses' knowledge, attitude and practices regarding infection control standard precautions among nurses who work in hemodialysis unit.

Table 5 :KAP by basic characteristics of participants:

Variable	Overall knowledge	P value	Overall attitude	P value	Overall practice	P value
Age						
25-30	14.7± 4.1	0.241	35.0± 25.5	0.015*	12.8± 1.3	0.646
31-35	14.6± 5.3		16.4± 23.7		11.0± 3.3	
36-40	11.6 ±4.5		22.5± 23.4		10.6± 3.5	
41-60	15.2± 3.3		50.0± 21.1		11.8± 2.6	
Level of education						
Diploma	12.8± 4.4	0.013*	25.2± 23.9	0.125	10.8± 3.1	0.074
Bachelor	16.8± 3.8		42.8± 29.3		12.9± 1.9	
Experience years						
1-5	16.3± 3.2	0.347	38.3± 30.2	0.303	13.3± 0.57	0.294
6-10	12.5± 5.6		21.3± 26.4		11.0± 3.0	
11-15	11.9± 5.3		13.2± 14.2		10.5± 3.0	
16+	13.8± 4.6		44.0± 25.1		11.5± 3.2	
Exposure to infection						
No	11.5± 4.4	0.108	26.9± 19.6	0.906	11.4± 2.7	0.985
Yes	14.4± 4.4		30.2± 27.8		11.2± 3.1	
Training on infection control						
No	11.1± 5.0	0.098	20.7± 22.8	0.571	9.6± 2.7	0.072
Yes	14.4± 4.3		31.5± 26.6		11.7± 2.9	

*Significant at 5% level

Table 5 summarized the results of tests of significant differences in overall knowledge, attitude, and practice by the basic demographic characteristics of nurses participated in the study. Significant differences in the overall level of knowledge were identified regarding the level of education, nurses with a bachelor's degree had a higher mean level of knowledge (16.8) compared to nurses with a diploma level of education (12.8). The overall level of attitude showed significant differences by the age categories of participants, those nurses who aged 41 to 60 years were had a high mean of attitude scale (50.0).

Part VI: Correlation between overall knowledge, attitude, and practice regarding infection control standard precautions among nurses who work in hemodialysis unit.

Table 6 Correlation between overall knowledge, attitude, and practice:

	Knowledge	Attitude	Practice
Knowledge	-		
Attitude	0.180	-	
Practice	0.434*	0.425*	-

*Significant at 5% level.

The results of correlation presented in table 5 reported positive and significant correlation between overall knowledge scale and overall practice scale. Moreover, overall attitude scale was significantly correlated with practice scale. No significant correlation was identified between overall knowledge scale and overall attitude scale.

V. RESULTS' DISCUSSION

The present study was conducted to determine the knowledge, attitude and practice regarding infection control standard precautions among nurses who work in hemodialysis unit in King Fahad hospital at ministry of health. Discussion of this study will be presented in the following six parts; **part I:** Assessment of the study participants' characteristics. **Part II:** Assessments of the study participants' knowledge, attitude and practice regarding infection control standard precautions among nurses. **Part III:** The relations between characteristics and the study participants' knowledge, attitude and practice regarding infection control standard precautions. **Part IV:** The relations between study participants' knowledge, attitude and practice regarding infection control standard precautions.

5.1 Assessment of the study participants' characteristics

In this study, nurses' knowledge, attitude and practice about infection control standard precautions of 37 nurses working in hemodialysis unit in King Fahad Hospital in the ministry of health. The analysis of the study participants' characteristics revealed that all of the study participants are female and most of the educational level is a diploma. Moreover, majority of the participants had more than 15 years of work experience. Also, more than half of study participant reported they are exposed to infection and majority of them received training regarding infection control.

5.2 Assessments of the study participants' knowledge, attitude and practice regarding infection control standard precautions among nurses:

The assessment of current study shows participants' knowledge regarding infection control standard precautions revealed that, the mean percent score of study participants had unsatisfactory level of study participants' knowledge regarding infection control standard precautions. Based on the study finding, less than half (45.9%) of nurses had good level of knowledge, while slightly less than one quarter (21.6%) had poor knowledge. The high level of knowledge referred mostly to the participants level of education, nurses with a bachelor's degree had a higher mean level of knowledge (16.8) compared to nurses with a diploma level of education (12.8).

By comparison of this finding with the findings of other studies which used the similar tool for measuring the knowledge about regarding standard precautions of infection control, the current study finding was different findings of Abalkhail et al. (2021), who found that the mean percent scores of good levels of standard precautions of infection control knowledge among nurses was precisely over two third (67.6 %). Moreover, other study conducted by Al-Faouri et al., (2021), to determine the level of knowledge and practice among 300 registered nurses, who stated that the mean scores of the nurse knowledge in their study were majority indicated a high level of knowledge among the participants. The result showed a mean of a total knowledge score of about (81.35%). It was evident that most of the participants' who responded to the standard precautions' knowledge questionnaire.

Further study done Ali Awadallah Saeed. (2021) was consistent with current study. He conducted a study among the of 537 Health Care Workers (HCWs) (doctors and nurses) in three teaching hospitals to assess the knowledge, behaviour and practice of physicians and nurses and to compare them with regard to infection control in Sudan. They found that the overall result showed that 39.6% doctors and 53.5% nurses had good level of knowledge while 59.5% doctors and 46.5% nurses had fair knowledge.

The assessment of knowledge regarding hemodialysis nurses on infection control standard precautions was performed using 20 items. The items were covering the holistic aspect of standard precaution of infection

control. Knowledge is essential to develop a positive attitude therefore is a key instigator to bring a positive change in practice. Evidence suggests that knowledge and positive attitudes are associated with improved compliance with infection control standard precautions among health care workers (Abalkhail et al., 2021).

The hemodialysis is major cause of hepatitis (Alfurayh et al., 2000). So, standard precautions are used for the care of hemodialyzed patients regardless of their diagnosis and perceived infection status. In relation to basic infection control knowledge, the current study results revealed that majority (94.6%) of participants had a good level of knowledge regarding usage of standard precautions. Moreover, majority of them correctly answered the knowledge statements related to wearing and changing gloves for each patient. These findings are consistent with study conducted by (Abalkhail et al., 2021).

With regard to the attitude, our study found that the majority (56.8%), of participants had poor attitude, only less than quarter (24.3%) of nurses were found to have a positive attitude. The distribution of positive attitude by item reported that the highest positive attitude was related to the items of Standard precaution is not easy to follow (56.8), while the lowest positive attitude was related to the items of It is not logical to assume all patients contagious unless their infection has been confirmed (29.7). Which is considerably low when compared with studies conducted in Saudi Arabia (Abalkhail et al., 2021) and Egypt (Abou El-Enein & El Mahdy, 2011). This difference between our study and the other study is because of using different classification systems, such as any score of $\geq 60\%$ were classified as positive attitude, while the classification system for positive attitude in our study was 80%. The overall distribution of level of attitude scale showed a high percentage of poor attitude among participants (56.8%), only 24.3% of nurses were found to have a positive attitude. The distribution of positive attitude by item reported that the highest positive attitude was related to the items of Standard precaution is not easy to follow (56.8%), while the lowest positive attitude was related to the items of It is not logical to assume all patients contagious unless their infection has been confirmed (29.7%).

Our study found that more than half of nurses included in the study reported a good level of practice (54.1%), the percentage of low practice level was found to be 13.5%. High percentages of good practice were reported in the items related to always performs hand hygiene when comes in contact with patients, always performs hand hygiene after taking off gloves, always washes hands immediately after contacting any blood, body fluid, secretion, excretion, or dirty substances, and always wears gloves when drawing blood samples (89.2%). The lowest percentage of good practice was found to be related to the item of always dispose of needles, blades or any other single use sharp objects in a sharp disposal container after use (46.9%).

This rate is higher when compared to the findings from studies conducted in Vietnam (46.1%) (Thu, Anh, Chau, & Hung, 2012), but lower than the rate reported among nurses in Ethiopia (60.2%) (Asmr et al., 2019). These differences in the level of practice of infection control standard precautions in different countries may be due to the differences in education, training, organizational culture, policies, presence of infection control guidelines and monitoring of its implementation. The overall level of attitude showed significant differences by the age categories of participants, those nurses who aged 41 to 60 years were had a high mean of attitude scale (50.0).

Regarding the practice of infection control standard precautions, our results showed that all characteristics of the participants like, age, level of education, experience and training on infection control were statistically not significantly associated with good practices. This is inconsistent with studies conducted by Abalkhail et al. who reported that all characteristics of the participants like, age, gender, experience and training were statistically significantly associated with good practices. Therefore, it is important that health-care facilities organize regular training programs on infection control standard precautions for the nurses who work in hemodialysis unit to refresh and update their knowledge and promote positive attitude and good practice. The study results reported positive and significant correlation between overall knowledge scale and overall practice scale. Moreover, overall attitude scale was significantly correlated with practice scale. No significant correlation was identified between overall knowledge scale and overall attitude scale.

VI. CONCLUSION AND RECOMMENDATIONS

Having good level knowledge, positive attitude and good level practice of infection control standard precautions in nurses who work in hemodialysis are vital to prevent the spread of infections from health-care facilities. Our research highlighted the KAP deficiencies of the nurses working at hemodialysis unit in King Fahad Hospital in Jeddah city, in KSA, level of education correlated with knowledge, which indicate that university programs sufficiently include infection control subjects in healthcare establishments. We also discovered a favorable correlation between good knowledge and practice. Setting up training programs for nurses might therefore be helpful in refocusing and enhancing their usual measures for infection prevention is anticipated, as well as facilitation of positive mindset and behavior.

VII. RECOMMENDATIONS

Based on the discussion of the study results, the following recommendations were issued:

6.2.1 Recommendations for education:

- Special training sessions should be designed and presented to nurses who performing hemodialysis.
- Nurses should be provided with in-service education, specially who had diploma in nursing to update their level of knowledge regarding on infection control standard precautions to reflect positive attitude.

6.2.2 Recommendations for administration:

- It is essential that hospital managers organize intensive training programs for these nurses as an ongoing component of staff development.
- It is also essential that hospital managers ensure an environment conducive to learning, and an adequate supply of all materials for the effective implementation of stander precaution techniques in hemodialysis unit.

6.2.3 Recommendations for practices:

- Strict adherence monitoring regarding the application of stander precaution techniques in hemodialysis unit should be made a policy to be strictly adhered to by clinical nurses.

Limitation

In this study, nurses' knowledge, attitude and practice about infection control standard precautions among 37 nurses working in hemodialysis unit in King Fahad Hospital. Two nurses were excluded due to maternal leave. The study needs to be conducted n larger number of nurses.

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