Review Article

International Journal of Dental and Health Sciences
Volume 05,Issue 01

PREVENTION AND CONTROL OF HEALTHCARE ASSOCIATED INFECTIONS (HAI) AT HEALTHCARE ORGANIZATIONS (HCO) : A REVIEW STUDY

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ABSTRACT:

Infection control is an critical part of practice to all health care workers, and it is considered to be the most cost-beneficial medical interventions. Hospital staff in general, and medical schools' students in particular, are susceptible to contract infectious diseases, because of their contact with patients or infective materials from patients. The aim of this review to summarize the most essential issues related importance of infection control and prevention in a healthcare settings and recommendations including infection control guidelines and programs. In addition to the factors that affect adherence to infection control guidelines by health care workers. This review concluded that infection prevention practices and control are critical activities that influence the quality of health care services, a lot of recent infection control guidelines were developed, and all health care workers should be able to access occupational health services.

Key words: infection control and prevention, health care workers, guidelines.

INTRODUCTION:

Health care associated infections (HAI) are infections that develop as a direct result of medical or surgical treatment or contact in a health care setting. They can occur in hospitals and in health or social care settings in the community and can affect both patients and health care workers. [1,2]

Health care associated infections are a worldwide problem. They occur across all points of health care delivery ranging from care provided in the home of the patient to the tertiary facility that provides complex procedures such as organs transplantation. [3] Health care associated infection causes significant morbidity, mortality and cost. Healthcare organizations (HCOs) must have systems in place to minimize the risk of preventable infection in order to deliver health care in a safe and cost-effective manner. Researches demonstrate the effectiveness of infection control programs in reducing health care associated infection. [1-3]

Infection control and prevention (IC) in a healthcare setting requires a comprehensive, coordinated program designed to prevent and control nosocomial or healthcare-associated infections (HAIs). The Centers for Disease Control and Prevention (CDC) restricts the usage of the term nosocomial to infections acquired in hospitals, whereas HAIs refer to infections in any type of healthcare setting.[2]

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Control of hospital-acquired infections is a major concern for all medical workers. That made the need of application of good infection control practices essential in every hospital.[4,5]

IC is a required, patient-focused function for any healthcare setting desiring to maintain accreditation by the Joint Commission on Accreditation of Healthcare Organizations (Joint Commission or JCAHO). The Joint Commission's description of IC states that there must be ongoing surveillance, data collection, and analysis of risks associated with the acquisition or transmission of infectious agents within the healthcare setting. Part of this IC program must include integrating with the community and recognizing that IC is larger than just within hospital settings.[6]

This review aims to summarize the most essential issues related importance of infection control and prevention (IC) in a healthcare settings and recommendations including infection control guidelines and programs. In addition to importance of infection control to the medical schools' students and factors that affect adherence to infection control guidelines by health care workers.

1. Infection Control guideline and Program:

Infection control is an important part of practice to all health care workers (HCWs), and it is considered to be the most cost-beneficial medical interventions. HCWs in general, and dental health care workers (DHCWs) in particular, are susceptible to contract infectious diseases, because of their contact with patients or infective materials from patients.[2-5] These infectious diseases are caused by various microorganisms such as: Hepatitis B virus (HBV), Hepatitis C virus (HCV), Human Immunodeficiency virus (HIV), Tuberculosis (TB), Rubella, Mumps, Staphylococci, Streptococci and Influenza.[7] The infectious process is similar to a circular chain that represent the factors involved in the process of diseases transmission, which are: first: the causative agent, which must be of sufficient number and virulence to destroy normal tissue; second: the reservoirs as: body tissues and the wastes of humans, animals, and insects, and contaminated food and water, in which the organism can thrive and reproduce; third: a portal through which the pathogen can leave the host; fourth: a mode of transfer, such as the hands, air currents, vectors, or other means by which the pathogens can be moved from one place or person to another; fifth: a portal of entry through which the pathogens can enter the body of the new host, open wounds and the respiratory, intestinal, and reproductive tracts are some of the portals of entry; finally the susceptible host, the host must, not have any immunity to the disease or adequate resistance to overcome the invasion by the pathogens to be susceptible to infectious diseases. The infection will occurs only if each

factor is present and in proper sequence.[7] In dental clinic, which is an environment where diseases transmission occur easily, infections may be transmitted through several routes including: direct contact with blood, oral fluids or other secretions; indirect contact with contaminated instruments, equipment, or environmental surfaces; or by contact with airborne contaminants present in either droplet splatter or aerosols of oral and respiratory fluids.[7]

In 1970s, many reports indicated that dentists were three times more likely to conduct HBV than general population. Also, with the emerge of Acquired Immunodeficiency Syndrome (AIDS) epidemic in the 1980s, infection control precautions become necessary to protect HCWs and the public effectively.[7]

As a response the Center of Disease Control and Prevention (CDC) introduced the concept of " Universal Precautions" in 1985.[7,8] Universal precautions, as the CDC defined it, refer to a precautions designed to prevent the transmission of HIV\AIDS, HBV and other Blood Borne Viruses (BBV) in the healthcare setting.[8,9] The limitation of universal precaution was recognized by CDC in 1996 and the concept was expanded to "Standard Precautions", which include precautions required to prevent the spread of airborne infection and those infections transmitted by excretions and secretions, that aim to ensure safe working environment for DHCWs and their patients,[7,8,10,11] which was updated and published in 2003.[9] According to this concept all patients must be considered as a possible source of infection. Generally saliva is not considered to be infectious but special precautions should be followed in dentistry due to possible contamination with blood and also it is not possible to identify all patient with infectious diseases, so standard precaution must be universally implemented with all patient regardless of patients status.[9,11,12] Standard precautions include: hand hygiene, use of personal protective equipment (PPE); such as gloves, eye protection, face mask and gowns, safe handling of sharps (including injury management), patient care equipment and environment surfaces.[11,13] Awareness and compliance with these recommendations are very important for the prevention of occupational and contagious infections in healthcare workers and also for protecting DHCWs.[14]

Hand Hygiene (HH):

Hands of DHCWs, and HCWs in general, are considered to be the most common mode of pathogen transmission.[13,15,16] As they directly contact patients which may spread infections including Healthcare Associated Infection (HAI),[15,16] is a localized or systemic condition resulting from adverse reaction to the presence of an infectious agent(s) or its toxin(s) that was not presence on admission to the acute care facility as defined by CDC.[17] So, it is

important to perform hand hygiene to avoid hand contamination. In dentistry, hand hygiene can play an important role because the contamination of hand by blood, body fluids and saliva is very ease to occur in dental procedures.[16]

HH is considered as the most critical preventive measure for reducing the risk for transmitting organisms to patient and HCWs.[11,13:16] HH is a general term that applies to: routine hand washing, antiseptic hand washing, antiseptic hand rub or Alcohol-based hand rub and surgical hand antisepsis.[18]

The applied method of HH depend on many factors: type of procedure, the degree of contamination and the desired persistence of antimicrobial action on the skin. Routine hand wash or social hand wash is usually done by water and non-antimicrobial soap, as plain soap, for 20-30 seconds to remove soil and transient microorganisms. While antiseptic hand wash is performed by antimicrobial soap, as chlorhexidine, iodine and iodophors, chloroxylenol [PCMX], triclosan, also for 20-30 second but that will destroy transient microorganisms and reduce resident flora. Alcohol-based hand rub remove or destroy transient microorganisms and reduce resident flora but in this method rub hands until the agent is dry. On the other hand surgical antiseptic is done by either water and antimicrobial soap, as chlorhexidine, povidone- iodine, or by water and non-antimicrobial soap, as plain soap, followed by an alcohol-based surgical hand-scrub product for 2-6 minutes to destroy transient microorganisms and reduce resident flora. Hand washing must occur: before and after each work shift or work break, before and after each contact with patients, before and after using gloves, after contact with used equipment, whenever hands become visibly soiled, before and after eating and after using the toilet.[12] Alcohol-based hand rub is considered to be the best method for hand hygiene because of it is rapid and effective antimicrobial action also that it improved skin condition and it is more accessible than other methods, but it had a major limitation as it cannot be use if hands are visibly soiled.[13] Many studies on hand hygiene have been conducted on HCWs around the world, a few of them were on hand hygiene compliance in dentistry.[18]

A cross-sectional study was carried out in Nigeria in 2010 on Dentists and Dental students treating patients who attend the University of Benin Teaching Hospital dental clinic with self-administrated questionnaire. The result of the study shows that 93.3% of respondent believe that hand washing is important in dentistry, but only 25% of them wash their hands before wearing gloves with 98.1% wash their hand when it is visibly soiled, while 46.7% wash their hands after removing gloves and before re-gloving. About 91.4% , 92.4% , 89.5% of the respondents indicated that hand washing help to prevent speared of infection. Forgetfulness , lack of time and inadequate facilities were some barrier to regular hand hygiene. The

study revealed high knowledge and positive attitude to hand washing, but also indicated an inadequate hand hygiene practices, with poor monitoring of hand hygiene by the health institution.[15]

Personal Protective Equipment (PPE):

The increase incidence of infectious diseases become a major threat to DHCWs safety[19,20] as well as the safety of their patients. Because of that the CDC recommended the use of PPE,[21] which are equipments worn to minimize exposure to variety of hazards,[1]to protect both DHCWs and their patients during routine examination and all other dental procedures, apart from providing the patient a sense of security and trust toward the dentist.[22] Primary PPE used in oral health-care settings includes gloves, surgical masks, protective eyewear, face shields, and protective clothing. The PPE reduce the risk of acquiring infections, but does not completely eliminate it. It is important to use them effectively, correctly, and at all times where contact with blood and other body fluids may occur, and it is also important that DHCWs remove all PPE before leaving patient-care areas. Continuous availability and adequate staff training are essential for proper use of PPE.[1,23]

Because hands are considered to be a major source of infection, especially nails,[22] the routine use of gloves by dental practitioners was one of the important recommendation among the guidelines.[20] The gloves may be worn of many reasons but the main reasons are: to protect DHCWs from being contaminated with blood or any other body fluids, to protect patient from being infected with any pathogens by providers.[19,21] and also to assure to the patients that the DHCWs are aware of the danger of infections and taking steps to avoid it.[20] There are a wide variation in the type of materials that gloves are made of. The various type of gloves are not equal in the way they protect and not all procedures require the same level of protection but there is no published guidelines to choose gloves based on type of materials of manufacture. Because of that the preference of providers for a particular type of gloves may be determined by many factors as: comfort, allergies, dexterity and cost. Although type of gloves and the length and type of procedures are known to effect the integrity of the gloves.[19] Some DHCWs avoid using gloves as a routine practice for many reasons as: it reduce sensation, restrict movement, low risk of infection, patient acceptance, skin reaction and lack of supplies.[20,21] However, the use of gloves does not replace hand washing, it is recommended to wash hands before and after gloving, and also recommended to dry hands before gloving because wet hands facilitate rapid multiplication of bacteria under gloves. According to some studies the percentage of DHCWs who use gloves on a routine bases are greater than those who never use gloves or use gloves for selected patients.[20]

Another method of protection is wearing suitable face masks to block particles of aerosols, which are a contamination source in dental environments.[21,23] Because masks protect the mucus membrane of the mouth and nose, they must be worn whenever there is a potential splashing, spattering or a spraying of blood, saliva or other body substance, or when there is a probability of inhaling or transmitting airborne pathogens.[23] But the face mask may be a source of infection if it was worn for long time, this will occur if it was touched by contaminated hands or if it become wet with exhaled air.[21]

Wear protective eyewear/goggles/visors/face shields to protect the mucous membranes of the eyes when conducting procedures that are likely to generate splashes of blood, body fluids, secretions or excretions. If disposable, discard appropriately. If they are reusable, decontaminate them according to the manufacturer's instructions.[20]

Sterilization:

Sterilization is an essential step in the reprocessing of reusable dental instruments that have become contaminated, or are potentially contaminated, with saliva, blood or other biological fluids. This includes dental hand pieces. The aim of sterilization is to break the chain of potential cross-infection between patients by killing microorganisms, including spores. However, prion proteins are not fully deactivated by the sterilization process. Therefore, effective instrument cleaning is particularly important to physically remove contamination, including prion proteins, prior to sterilization. The decontamination of reusable dental instruments includes: cleaning, thermal disinfection if a washer-disinfector is available, rinsing, drying, inspection for dryness, functionality and cleanliness, wrapping before sterilization when using a vacuum sterilizer, sterilization, wrapping after sterilization when using a non-vacuum sterilizer.[24] According to the CDC, the nature of disinfection could be understood more readily if instruments and items for patient care were divided into three categories— namely, critical, semi-critical, and noncritical— on the basis of the degree of risk of infection involved in the use of the items.. All critical and semi-critical dental instruments that are heat stable should be sterilized after each use by steam under pressure (autoclaving), dry heat, or chemical vapor. Before sterilization or high-level disinfection, instruments should be cleaned so that any debris is removed.[25]

Sharps Injuries:

Because of the dental environment nature including: the small operating field, routine use of sharp instruments and direct contact with blood and saliva, dental clinics are considered to be hazardous sites.[26] DHCWs are at high risk of more than 20 different type of blood borne pathogens (BBP) that could cause about 1000 infection per year[27]

as: HBV, HCV and HIV, which are the most common types that could be transmitted to DHCWs through sharp injuries, especially Needle-stick Injuries(NSIs).[27-30] NSIs is a hidden problem as DHCWs mostly forget it, after it happen, and get on with their work. [28] Because of that it considered to be the greatest occupational risk that can transmit among infectious diseases.[29] The risk of diseases transmission is influenced by many things as: the presence of visible blood on the needle, the type and number of microorganisms in the blood, the depth of the injury and the type and size of the needle used.[28] It is estimated that about 600000 to 800000 NSIs occur in HCWs each year in the United States, also about half of them are not reported.[27,30] However, the risk of infection after single NSI is about 30-50%for HBV, in non-immunized person, 3-10% for HCV and 0.2-0.5% for HIV.[27,29,30] In Saudi Arabia the prevalence of HBV is about 10% for the entire population and about 2-6% for HCV, depending on geographic location, which make DHCWs at a considerable risk of HBV and HCV transmission. A study was conducted in 2007 to assess the occurrence of accidental exposure in DHCWs in Riyadh shows that 74.2% of total occupational injuries were from needle stick. Also, the sample has inadequate adherence to infection control practice with under reporting of exposure incidence. But the accidental occupational exposure in Riyadh was lower than other parts of the world.[26]

To minimize the risk of NSIs or any sharp injuries DHCWs should carefully handle any sharp instruments, they should never leave sharps lying around or try to recap needles or retrieve them from a sharp container, the sharps should be for single-use and directly discarded into sharp containers immediately after use, also the sharp containers must be available at each location where sharps are used.[31,11] But if the sharp injury occur DHCWs should: encourage bleeding from the wound, wash the wound with soap and running water (without scrubbing the site of the injury), report the incident to the immediate supervisor, depending on the degree of exposure and its source it may be necessary to take further actions.[11]

Immunization:

The immunization status of DHCWs can play an important role, as immunization substantially reduce the number of DHCWs susceptible to infectious diseases as well as the potential for disease transmission to other staff and patients. And it is considered to be an essential part of infection prevention and control programs.[32]

In 1999 vaccination, which is an inoculation with a vaccine with the intent of producing immunity,[33] was listed by the CDC as one of the 10 greatest achievements of the 20th century. As they provide long-term immunity without the necessity for repeated administrative antibiotics. Vaccinations are important DHCWs

because many of these infections can present occupational risks for them. It have changed the face of infectious diseases by lowering their incidence of many infectious diseases and have resulted in increasing health and life expectancy of the population. By receiving the recommended vaccines DHCWs can further protect themselves [34] from many common vaccine-preventable diseases (VPDs) such as: HBV, Influenza, Measles, Mumps, Rubella, Varicella.[35]

Hepatitis-B Virus (HBV) is a major worldwide as it cause acute and chronic liver infection, cirrhosis, and primary hepatocellular carcinoma.[36] And has long been recognized as an occupational hazard among dentists.[37] Many studies have shown that dental personnel have a five- to ten-fold chance of acquiring hepatitis B infection than the general population.[38] HBV is transmitted primarily through parenteral and sexual exposure to HBsAg-positive blood or other body fluids from individuals who are chronic HBV carriers or have acute hepatitis B. To decrease the risk of HBV infection, it is recommended that DHCWs receive HBV vaccinations, which has been available since 1982 and, since 1990 has been recommended for all HCWs whose activities frequently expose them to blood, and use individual protective equipment, such as gloves, to prevent BBP infection during dental procedures.[37]

The prevalence of HBV infection in HCWs is higher than in blood donors, yet despite the availability of the HBV vaccine, a considerable proportion of dentists remain unvaccinated. A study at the Johns Hopkins Hospital found that about 23% of health workers were not vaccinated. To date, vaccine acceptance among dental HCWs has not been assessed in most parts of Saudi Arabia.[39]

Also there is little recent data on the acceptance and uptake of the vaccine amongst Saudi DHCW. The results of a report published in 1991, showed a relatively low awareness and uptake of the vaccine amongst dental staff at a university dental clinic Riyadh, with only one half of the sample aware of its availability, more than two-third not vaccinated.[40]

Hepatitis C virus (HCV), an RNA virus, which is structurally unrelated to other hepatitis viruses,[41] is one of the fastest growing infectious diseases and the most common BBP infection in the United States and Australia.[42] HCV is transmitted mainly through blood products. However, chances of transmitting the HCV through a needle sticks are greater than the HIV.[43] Although, The transmission of the HCV by saliva alone is a remote possibility unless the saliva is contaminated with blood.[45] HCV can also be found in saliva from HCV-positive individuals and it has been suggested that transmission of HCV has occurred through human bites.[45] The probability of transmission may depend on the infectivity (viral load levels) of the infected person. Although

dentists are exposed to both saliva and blood, but epidemiological studies have not indicated that dentists are at an increased occupational risk of contracting HCV.[46] In addition; There is an ongoing effort to create a HCV in part, because an effective cure for HCV does not currently exist. There are some treatments with promise, but the infection can still persist for life in carriers and cause serious health impairments.[23]

Acquired Immunodeficiency Syndrome (AIDS) is caused by the human immunodeficiency virus (HIV).[47] The route of transmission for HIV is person to person via: sexual contact, sharing of needles contaminated with HIV, infusions that are contaminated with HIV, transplantation of organs or tissues that are infected with HIV[41] The risk of acquiring HIV after a needle-stick or other "sharps" injury is very low 0.5%[38] Individuals who have received a needle-stick injury from an HIV positive patient should go to the occupational health unit at their institution for counseling. But unlike HBV, there is no vaccine or immune globulin which would decrease the risk of contracting these disease.[39]

Tuberculosis (TB), a chronic bacterial infection and it is primarily an airborne disease, causes more deaths worldwide than any other infectious disease. TB is spread through the air and usually infects the lungs **,**although other organs are sometimes involved. The disease is not likely to be transmitted through personal items belonging to those with TB, such as clothing, bedding, or other items they have touched. Adequate ventilation is the most important measure to prevent the transmission of TB. [39]

Another important immunization is the influenza vaccine, it is an annual vaccine administered to protect against highly infectious airborne pathogens. Influenza is a very acute infection that knocks people off their feet for 5 to 7 days with severe muscle aches, fever, headaches, raspy cough, and a general run-down feeling. And many HCWs, and DHCWs, still do not get the influenza vaccine on an annual basis, as they “do not get sick” is their common excuse for that. [37]

2. Importance of Infection Control to medical schools’ Students:

As medical schools’students have increasing patient contact during their education and clinical training, they are at high risk for exposure to pathogens. It is the responsibility of academic institution to facilitate appropriate preclinical immunization and provide infection control training,[48,49] baseline knowledge must be obtained in the preclinical period, [8] to protect patients and students, and to educate the future healthcare professionals in safety work practices. [48,49]

Most studies of dentists’ infection control practices have investigated compliance with specific procedures, such as the use of gloves and masks, eye protection, HBV vaccination. There are

few comprehensive studies of dentists' compliance with recommended infection control procedures.[3] Also, around the world there are only few studies about dental students knowledge and attitudes toward infection control.[38,39]

Self administrated questionnaire was distributed among 245 dental students including preclinical students to determine their level of knowledge, attitude and practice toward infection control in central India. The study result indicated that 95.5% of the respondents watch their hand before and after examining patients, while only two students use the face mask, gloves, eye wear and protective clothing as a standard infection control measure. With 61.2% of the students had not been vaccinated with hepatitis B vaccine and only 32.2% of them agreed that hepatitis B has the highest rate of transmission via saliva. This study indicated that dental students has poor level of knowledge and practice of infection control measure with positive attitude for great compliance was needed. Also lack of understanding of the basis of infection control measures and prevention of communicable infectious diseases was not tested. [7]

Unfortunately literature review indicate that there are many published studies about medical colleges students, while the most studies covered infection control procedures among healthcare professionals.[50-59]

3. Factors that affect adherence to infection control guidelines

A variety of challenges face infection prevention and control in healthcare institutions. This was evidenced by the disparity in knowledge, attitudes, practice and compliance by health care workers. Studies had shown that poor decontamination of instruments and ineffective infection prevention practices and control often led to outbreaks of nosocomial infections.[60-64]

Knowledge is defined as "understanding of or information about a subject which a person gets by experience or study, and which is either in a person's mind or known by people generally". The term knowledge is also used to mean the theoretical or practical understanding of a subject.[65] The knowledge of people greatly affects the safety, effectiveness, comfort and satisfaction with which the goals of an individual or an organization are formulated and attained.[66]

Attitude is defined as a predisposition to classify objects and events and to react to them with some degree of evaluative consistency. Attitudes are acquired by social interaction, not learned from the textbooks. Positive attitudes toward health promotion need to be developed during students' days rather than afterward.[65] And measurement of the attitude section through a numerical value can be assigned to each choice in the range of responses with the middle response given a score of zero and positive and negative scores assigned to

those around it. In this way a score can be calculated for each individual in relation to the highest possible score.[66]

One previous study was conducted to determine the health workers adherence to infection prevention and control policies and procedures at a Level 4 Hospital in Kenya. A descriptive cross-sectional survey design were used. The objectives of the study were to: Identify existing infection prevention and control policy guidelines at the level four hospital; Evaluate the implementation of infection prevention and control measures; and to Identify the barriers to compliance with infection prevention practices and control measures. The results revealed that Health Care Workers (HCWs) had good knowledge on infection prevention practices and control. There were written infection prevention practices and control (IPPC) policy guidelines and high awareness (98.7%) of the IPPC policy guidelines. The record review showed that there was approximately 6.7% nosocomial infections rate among hospitalized patients. Barriers to IPPC compliance among the health care workers (HCWs) included frequent shortage of water, inadequate updates on IPPC through continuing professional education and inactive IPPC committee.[67]

The centers for disease control and prevention reports hospital adherence to hand hygiene as abysmal. observational studies find rates of 5% to 81%.[68]

A 2010 systematic review confirmed median adherence of only 40%, with lower rates being seen in intensive care units, by physicians compared with nurses, and before compared with after patient contact.[69] even a recent, well-designed, randomized controlled trial of infection control was hampered by poor adherence to hand hygiene, with only 69% adherence demonstrated in an intensive care unit trial to reduce the spread of resistant bacteria.[70] The World Health Organization, The Joint Commission, and professional societies have called for increased hand hygiene compliance by health care workers.[68,71-73]

Nurses in particular are often exposed to various infections during the course of carrying out their nursing activities. Therefore nurses should have sound knowledge and strict adherence to infection control practice. Previous Arabic study aimed to assess the level of knowledge and practice of infection control among nurses in governmental hospitals of Palestine. the study was conducted between November, 2014 and January, 2015 in governmental hospitals found in North West bank districts. The results revealed that, approximately half (53.9%) of the studied sample had fair knowledge level (>80%). However, the majority (91.1%) of the studied sample had Good practice (>80%). No significant statistical differences were found between mean knowledge scores towards age, years of experience, and training course. Significant statistical differences were

found between mean knowledge scores towards gender and qualification. No significant statistical differences were found between mean practice scores towards age, years of experience, training course, and qualification. Significant statistical differences were found in mean practice scores only in relation to gender. The study concluded that in spite of having good practice level regarding infection control, nurses had fair knowledge level.[74]

Another Arabic study aimed to evaluate infection control knowledge, attitude, and practice in Lebanese private dental clinics. The study used a survey including 46 questions related to routine safety procedures was sent to 1150 Lebanese dentists between July 1st and 2nd, 2015. The study sample was selected from the database of registered dentists based on a proportional random sampling ensuring equitable representation of the 5 geographic regions of Lebanon. A subset of 29 questions was used to generate an overall score of compliance (excellent, good, fair, and poor). The results revealed that, 417 dentists returned the completed questionnaires. 96% expressed concern about infection transmission, 90.6% were vaccinated against Hepatitis B, and 61.8% asked routinely about patients medical history. Only 43% used protective eyewear. Although most dentists (65%) used autoclaves, dry heat was still used. Less compliance was shown by clinicians with fewer years of experience. In the overall compliance questionnaire, the mean percentage of correct answers was roughly 54% with <5% of the practitioners scoring “excellent. The study found inadequacy of compliance in private Lebanese dental clinics necessitating improved educational training and sustained monitoring by regulatory bodies.[75]

CONCLUSION:

Infection prevention practices and control are critical activities that influence the quality of health care services. A lot of recent and updated guidelines on infection prevention and control programs were developed by World Health Organization, Centers for Disease Control and Prevention and Joint Commission International Accreditation Standards For Hospitals. Previous studies were done to identify the barriers to compliance with infection prevention practices and control measures.

The review indicated that all health care workers should have a system in place to manage the occupational health needs and obligations of staff in relation to infection. All staff should be able to access occupational health services or appropriate occupational health advice. There should be policy on the prevention and management of communicable infections in care workers.

Occupational health services for staff should include risk-based screening for communicable diseases and assessment of immunity to infection after a conditional offer of employment and on-going health surveillance; offer of relevant immunizations; and having

arrangements in place for regularly reviewing the immunization status of care workers and providing vaccinations to staff as necessary in line with Immunization against infectious disease.

REFERENCES:

1. World Health Organization (2016) Guidelines on Core Components of Infection Prevention and Control Programs at the National and Acute Health Care Facility Level.
2. Centers for Disease Control and Prevention. (CDC): (2017). Guidelines for Environmental Infection Control in Health-Care Facilities.
3. National services Scotland. (2016). National Infection Prevention and Control Manual.
4. NHMRC. (2010) Australian Guidelines for the Prevention and Control of Infection in Healthcare. Commonwealth of Australia.
5. The Health Foundation. (2015) Infection prevention and control: lessons from acute care in England
6. JCI (2013). Joint Commission International Accreditation Standards For Hospitals, 5th Edition.
7. Singh A, Purohi B. Knowledge, attitude and practice towards infection control measures and it's correlation among dental students in Bhopal city, Central India. Int J Infect Control. 2011;11: 1-9 .
8. Barlean L., Danila I., Hanganu C. Educational compliance with infection control practices in dentistry. OHOMBSC. 2004;2:21-6.
9. Askarian M., Assadian O. Infection control practices among dental professional in Shiraz dentistry school, Iran. Archives of Iranian Medicine. 2009;12:48-51.
10. Hoy J., Richmond J. Standard precautions and infection control. In: Brandford D., Dore G., Grulich A., Kidd M. HIV, viral hepatitis and STIs: a guideline for primary care. Darlinghurst, NSW: Australian Society for HIV Medicine; 2008:146-51.
11. Queensland Health.(2001) Infection Control Guidelines.
12. Centers for disease control and prevention. Guideline for infection control in dental health-care setting. 2003;52(No.RR-17).
13. Batista M., Vieira M., Rodrignes C., Costa A. Rate of compliance with hand hygiene by dental health care personnel (DHCP) within a dentistry healthcare first aid facility. European Journal of Dentistry. 2010;4:233-7.
14. Leggat PA, Kedjarune U, Smith DR. Occupational Health Problems in Dentistry: A Review. Industrial Health 2007; 45: 611-621.
15. Omogbai JJ.,Azodo CC., Ehizele AO., Umoh A. Hand hygiene amongst dental professionals in a tertiary dental clinic. Afr. J.Cln.Exper.Microbiol. 2011;12:9-
16. Horna T., Andrus M. CDC\NHSN surveillance definition of healthcare-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control. 2008;36:309-32.
17. International Society for Infectious Diseases (2008). Guide to Infection Control in the Hospital
18. Stevenson G. Attitude of dental students to hand hygiene practices at dental school. Taxas:UMI;2012:65.
19. Preetha P, Amy E, Jody C. Effectiveness Of Gloves And

Infection Control In Dentistry: Student And Provider Perspectives. Journal Of Dental Education. 2009;73:571-80.
20. Al-Moherat F., Abu Shagra K. Children's Attitude To The Use Of Gloves By Dentists. Pakistan Oral & Dental Journal. ;28:301-3.
21. Shyagali T., Bhayya D. Patient's Attitude And Knowledge Towards The Usage Of Barrier Technique By Orthodontists. Int J Infect Control. 2012;I3:1-8.
22. Bhayya D., Shyagali T. Parental Attitude And Knowledge Towards The Usage Of Barrier Techniques ByPediatric Dentist. People's Journal Of Scientific Research. 2011;4:29-33.
23. ADA Guidelines for Infection Control. Australia: Australian Dental Association Inc.2012:50.
24. Scottish Dental Clinical Effectiveness Program. sterilization of dental instrument dental instruments dental clinical guidance. Dundee :Dundee Dental Education Centre ;2011:31.
25. CDC sterilization, 2004 American Dental Association , Updated July 2009.
26. Al-Hussyeen A., Al-Sadhan S. Accidental occupational exposures occurring among dental healthcare workers in dental clinics in Riyadh, Saudi Arabia. Saudi Dental Journal. 2007;19:155-63.
27. Hashemipour M., Sadeghi A. Needlestick Injuries among Medical and Dental Students at the University of Kerman. A Questionnaire Study. Journal of Dentistry, Tehran University of Medical Sciences.2008;5:71-6.
28. N G., J T. Needle-stick Injuries in Dentistry. Kathmandu Univ Med J. 2011;35:208-12.
29. Cheng H., Su C., Huang C. Factors Affecting Occupational Exposure to Needle-stick and Sharps Injuries among Dentists in Taiwan: A Nationwide Survey. PLoS ONE. 2012;7:1-7.
30. Askarian M., Malekmakan L., Memish Z., Assadian O. Prevalence of needle stick injuries among dental, nursing and midwifery students in Shiraz, Iran. GMS. 2012;7:1-5.
31. Hoy J., Richmond J. Standard precautions and infection control. In: Brandford D., Dore G., Grulich A., Kidd M. HIV, viral hepatitis and STIs: a guideline for primary care. Darlinghurst, NSW: Australian Society for HIV Medicine; 2008:146-51.
32. Infection Prevention and Control Guidelines – College of Dental Surgeons of BC.2012
33. Sharon K ,Richard D (2009). Guidelines for Infection Control in Dental Health-Care Settings. Continuing Education Course.
34. World Health Organization.(2003). practical guidelines for infection control in health care facilities.
35. Immunization of Health-Care Workers: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). December 26, 1997,1-42:46
36. T. PAUL, A. MAKTABI. hepatitis b awareness and attitudes amongst dental health care workers in Riyadh ,Saudi Arabia . Odonto-StomatologieTropicale1999:9-12
37. Vera S, Henrique G. concerns regarding hepatitis b vaccination and post-vaccination test among

brazilian dentists. Virology Journal 2010, 7:154
38. Al-Rabeah A, Gad Mohamed A. infection control in the private dental sector in Riyadh, Annals of Saudi Medicine 2002;22:13-17
39. Al-Dharrab E, Al-Samadani K. Assessment of hepatitis B vaccination and compliance with infection control among dentists in Saudi Arabia. Saudi Med J 2012; 33:1205-10
40. practical guidelines for infection control In health care facilities. World Health Organization. 2003:1-74
41. Coates EA, Walsh L, Logan R. The increasing problem of hepatitis C virus infection. Aust Dent J 2001;46:13-17
42. Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. Centers for Disease Control and Prevention. MMWR Recomm Rep 1998;47:1-39.
43. Polish LB, Tong MJ, Co RL, Coleman PJ, Alter MJ. Risk factors for hepatitis C virus infection among health care personnel in a community hospital. Am J Infect Control 1993;21:196-200.
44. Levin ML, Maddrey WC, Wands JR, Mendeloff AL. Hepatitis B transmission by dentists. JAMA 1974;228:1139-40.
45. Herbert AM, Walker DM. Occupationally acquired hepatitis C virus infection. Lancet 1992;339:305.
46. Evans RH, Scadden DT. Haematological aspects of HIV infection. Baillieres Best Pract Res ClinHaematol 2000;13:215-30.
47. MOHP (2008), Egyptian National Guidelines For Infection Control.
48. Office of Infection Control and Environmental Safety. New Jersey Dental School Tuberculosis Infection Control Program And TB Respiratory Protection Program. Reviewed February 2013,Available athttp://dentalschool.umdnj.edu/about/envsafety/tb-policy.pdf
49. Kumar S, Sharma J. Infection control practices among undergraduate students from a private dental school in India. odontocienc. 2009;24:124-128.
50. Al-Kheraif A. , Mobarak F. infection control practice in private dental laboratories in Riyadh. Saudi Dental Journal. 2008 ; 20 : 163-9.
51. Al Shammery A. Infection control measures among dentists practicing In Saudi Arabia. Saudi Dental Journal. 2000 ; 12 : 77-82.
52. Feteih R. ,Abdelsalam M. , Jamjoom H., Farsi J . knowledge, attitude and behavior towards infection control Among dental health care workers in Jeddah , Saudi Arabia.
53. Paul T, Maktabi A, Almas K, Saeed S. Hepatitis B awareness and attitudes amongst Dental health care workers in Riyadh, Saudi Arabia. Odonto-StomatologieTropicale. 1999 ; 86 : 9-12.
54. AlsamghanA .knowledge and attitude of male dental students toward HIV/AIDS in king khalid university, Saudi Arabia. international Journal of Public Health and Epidemiology.2012 ; 1: 1-9 .
55. Mahran S. ,QalawaSh . Student's Knowledge and Attitude Regarding Infected Patients with Blood Borne Pathogenesis in College of Applied Medical Science at Kingdom Saudi Arabian. Journal of American Science. 2012 ; 8 : 657-65.

56. PaniS , Al Shalan A, Al Saigh H. Saudi dental students' perception of their education inSpecial Care Dentistry and its effect on their confidence to render care. Journal of Disability and Oral Health .2012;13:19-25.
57. Bokhari K, Shariff M, Wahab MA, Hassan Y. Accidental occupational Exposure Among Dental Healthcare workers in AsirRegion ,Saudi Arabia . journal of Orofacial research. 2012; 2 : 5-8 .
58. McCarthy G., Koval J., John M., MacDonald J. Infection Control Practices Across Canada: Do Dentists Follow the Recommendations?.Journal of the Canadian Dental Association. 1999;65:506-10.
59. Ozalp N, Dag C, Okte Z. oral health knowledge among dental students. clinical dentistry and research 2012; 36:18-24
60. Darwin P. Hunt. The concept of knowledge and how to measure it. Journal of Intellectual Capital 2003;4:100-13
61. K. Kaliyaperumal .Guideline for Conducting a Knowledge, Attitude and Practice (KAP) Study. AECS Illumination, 2004;13:7- 9
62. Zulu, M. B. (2001). Investigation of Infection prevention and control in selected Malawian Hospitals. African Journal of Nursing and Midwifery, 3 (1), 46-50.
63. Omari, M. (1997). Pattern of Bacteria infection and antimicrobial susceptibility at Kenyatta National Hospital. East African Medical Journal. 110, 135- 143
64. Muchina,P.,W, Muchina E.,N. (2009). Transmitting infection: Testing disinfectants used in maternty Units. African Journal of Midwifery and Women's health, 3(1), 12-14
65. Inyama, H. K., Revathi, G., (2009). The incidence of nosocomial infections: Kenyatta National Hospital- Intensive Care Unit. Kenya Nursing Journal 38 (1), 31-43
66. Creedon, A.A., (2005). Healthcare workers hand decontamination, practices with recommendation, practices with recommendation guidelines, Journal of advanced Nursing, 51 (93), 208-216.
67. Alice W. Gichuhi et al. Health Care Workers Adherence to Infection Prevention Practices and Control Measures: A Case of a Level Four District Hospital in Kenya. American Journal of Nursing Science. 2015; 4(2): 39-44
68. Centers for Disease Control and Prevention. Guideline for hand hygiene in health-care settings: recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/ APIC/IDSA hand hygiene task force. MMWR Recomm Rep. 2002;51(RR-16):1-45.
69. Erasmus V, Daha TJ, Brug H, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. Infect Control Hosp Epidemiol. 2010;31(3):283-294.
70. Huskins WC, Huckabee CM, O'Grady NP, et al. Intervention to reduce transmission of resistant bacteria in intensive care. N Engl J Med. 2011;364(15):1407- 1418.
71. Pittet D, Allegranzi B, Boyce J. World Health Organization World Alliance for Patient Safety First Global Patient Safety Challenge Core Group of Experts. The World Health Organization guidelines on hand

hygiene in health care and their consensus recommendations. Infect Control Hosp Epidemiol. 2009;30(7):611-622.

72. Joint Commission Center for Transforming Healthcare. Hand Hygiene Project. ttp://www.centerfortransforminghealthcare.org/projects/detail.aspx?
73. Cumbler Et, et al. Culture Change in Infection Control Applying Psychological Principles to Improve Hand Hygiene. J Nurs Care Qual : 2013
74. Fashafsheh Im , et al. Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals. Journal of Education and Practice. 2015 : (6) : 79-90.
75. Dagher Ji , et al. Infection Control Measures in Private Dental Clinics in Lebanon. International Journal of Dentistry;2017: 1-12.
76. Baddour A, et al. Use Six Sigma Approach To Improve Healthcare Workers Safety. International Journal of Pure and Applied Sciences and Technology,18(1)(2013), pp. 54-68