



ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PRACTICES AMONG HEALTHCARE WORKERS ON HOSPITAL-ACQUIRED INFECTIONS AND BIO-MEDICAL WASTE MANAGEMENT IN MEDICAL TEACHING TERTIARY CARE HOSPITAL.

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ABSTRACT

Introduction:- Hospital-acquired infections are one of the most common infections in the care delivery system. According to World Health Organization (WHO) approximately 7 % of patients in developed nations, and 15 % of patients in developing nations have been found to acquire at least one hospital-acquired infection. Inappropriate and inefficient disposal of bio-medical waste can lead to infectious hazards for healthcare workers. Keeping the above facet in mind, this study is conducted to define the level of knowledge, attitudes, and practices for the use of proper disinfection practices among healthcare workers. **Aims and objectives:-** To evaluate knowledge, attitudes, and practices for control of hospital-acquired infections and awareness regarding bio-medical waste handling among healthcare workers. **Material and method:-** This was an observational study that was conducted at the Sir. Takhtasinhji. Hospital and Government medical college, Bhavnagar. There were 569 healthcare workers, among them, 82 residents, 37 intern doctors, 77 nursing staff, 78 technicians, and 295 undergraduate students were included. **Result:-** In this study, healthcare workers had 73.28% good, 24.95% average, and 1.75% poor knowledge, attitudes, and practices regarding hospital-acquired infections and bio-medical waste management. **Conclusion:-** Regular systemic monitoring and knowledge evaluation of infection control and bio-medical waste management help in implementing and improving strategies for the prevention of hospital-acquired infection.

KEYWORDS : Hospital-acquired infection, attitudes, knowledge, and practices in HCWs, Bio-medical waste management.

INTRODUCTION:-

Healthcare-associated infection also called as a "hospital-acquired infection" or "nosocomial infection" which is an acquired infection that is not present or incubating at the time of admission to a hospital. It usually develops after 48-72 hours of admission to a hospital^[1,2]. This also includes symptoms of hospital-acquired infection that develop even after discharge from the hospital. Healthcare workers are also vulnerable to occupational infections; such as needle stick injury-transmitted infections^[3,4].

Hospital-acquired infections are one of the most common infections in the care delivery system. According to the World Health Organization (WHO), approximately 7% of patients admitted to healthcare centres in developed nations and around 15% in developing nations have at least one hospital-acquired infection^[1,2,5]. It is estimated that up to 30% of patients in developed countries have at least one hospital-acquired infection in the intensive care unit, while the incidence in developing countries is at least 2-20 times higher^[2,6]. Such hospital-acquired infections (HAIs) increase the risk of morbidity, mortality, and cost to the existing illness. All this leads to improving efforts to implement infection control programs in health centres. Infection control programs have been a part of patient care and management in almost all hospitals in developed nations and are fast peaking up in developing nations^[1,7].

Hospital-acquired infections are caused by viral, bacterial, and fungal pathogens transmitted from one patient to another patient by healthcare workers who do not practice infection

control measures like hand hygiene, wearing personal protective equipment(PPE), etc. The most common hospital-acquired infections are catheter-associated urinary tract infections, surgical site infections, respiratory tract infections, central line-associated bloodstream infections, and gastrointestinal infections^[1,3,8].

Any waste which is generated during the treatment or immunization of human beings or animals or in research activities, laboratory diagnosis, pertaining thereto or in the production or testing of biologicals is defined as bio-medical waste. The quantity of infectious waste ranges from 0.5 to 2 kg/bed^[1,9,10]. Out of the total hospital waste, 85% is general waste; 10% is infectious waste, and 5% is a chemical and radioactive waste^[11,12]. If proper disposal methods and precautions are not taken, accidents to healthcare workers (HCWs) in medical institutions generating medical waste can occur^[13]. Inappropriate and inefficient disposal of bio-medical waste can lead to infectious hazards, malignancies, malformations, and environmental pollution not only for the current generation but also for future generations^[14].

According to the Ministry of Environment and Forests (MoEF), the gross generation of bio-medical waste in India is about 484 TPD (tons per day)^[11]. According to the bio-medical waste rule (2016) with an amendment added in 2018 and 2019, segregation of waste should be done by using containers of four different colours, each designated for segregation of a particular waste category^[3,11].

Keeping the above facet in mind, this study is conducted to

describe the level of knowledge, attitudes, and practices for the use of proper disinfection practices among the resident doctors, intern doctors, nursing staff, laboratory technicians, and medical students in tertiary care centres and teaching facilities. They routinely attended the clinics and operation theatres, so evaluation of their knowledge and attitudes toward hospital-acquired infections and bio-medical waste management is of crucial importance.

AIM AND OBJECTIVES: -

To evaluate knowledge, attitudes, and practices for control of hospital-acquired infections and awareness regarding bio-medical waste handling among resident doctors, intern doctors, nursing staff, laboratory technicians, and medical students in tertiary care centres and teaching facilities.

MATERIAL AND METHODS: -

It is an observational, hospital-based, cross-sectional study that was conducted at Sir. Takhtasinhji hospital and Government medical college, Bhavnagar. The study group was comprised of healthcare personnel which included resident doctors, intern doctors, nurses, laboratory technicians, and undergraduate medical students from different wards, intensive care units, intensive cardiac care units, surgical intensive care units, kitchen area, and outpatient clinics at our institution. The selection was done on a random basis. In our institution, seminars and training related to hospital-acquired infections were done routinely. So, to analyze knowledge, attitudes, and practices for the prevention of hospital-acquired infections performed. There were 40 (forty) questions prepared that covered different aspects like universal precautions, hand hygiene, biohazardous waste management, post-exposure prophylaxis and vaccinations, disinfection, sterilization, linen management, and infection control policies. The conduct and evaluation of the above questionnaires are genuine, credible, and authentic.

There were 569 healthcare workers included in this study. Among them, 82 residents, 37 intern doctors, 77 nursing staff, 78 laboratory technicians, and 295 undergraduate students were included. Responses to the questions were given a score, which is known as the KAP score. The coding of the KAP score was as follows for each answer: 1 for true, and 0 for false or no. The total score was the sum of the scores for all questions ^(15,16).

Table 1: - KAP (knowledge, attitude and practice) scoring system

Good	31-40	76-100%
Average	21-30	51-75%
Poor	1-20	<50%

Microsoft word and Excel operating system have been used to generate graphs, tables and questions, etc.

Table 2: - Questionnaires to assess knowledge, attitudes and practices among healthcare workers

Sr.no	Questionnaires
1	What are hospital-acquired infection/nosocomial infections? a. Infection acquired from hospital b. Infection acquired from community c. Infection of nose d. Common cold and cough
2	The symptoms appear after how many hours of admission that can be defined as healthcare associated infection? A. 24 b. 48 c. 06 d. 12

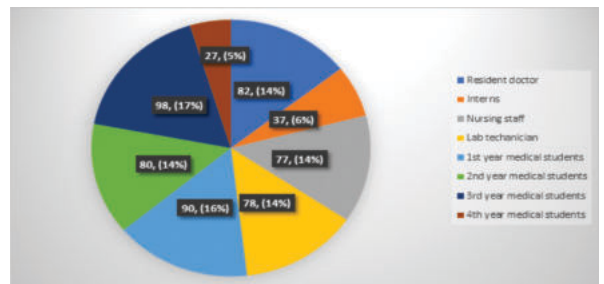
3	Do you believe that health care workers are at risk of acquiring a hospital-acquired infection? a. Yes b. No
4	Isolation, precautions can decrease transmission of nosocomial infection. - a. Yes b. No
5	Is there any relationship between length of hospital stay and risk of infection? a. Yes b. No
6	If one of the link in the chain of transmission is interrupted, an infection will not occur? a. True b. False
7	Having food and drinks at the patients' places- a. Always done b. Never done
8	Informing the doctors if any edema, inflammation, or infiltration occurs around the catheter opening. a. Always done b. Never done
9	Are you aware of universal precautions? a. Yes b. No
10	Universal healthcare precautions should be observed- a. at all times for all patients b. at only for HIV patients c. at only in the OT d. none of the above
11	What is the universal precaution? a. To avoid contact with patients' body fluids. b. Wearing medical gloves, goggles and face shields c. Used personal protective equipment d. All of above
12	Wearing clean gloves on drug injection or catheter insertion. a. Important b. Not Important
13	Will hand washing and hand hygiene prevent the spread of infection from patient to patient? a. Yes b. No
14	Hand rubbing and hand sanitizing should be performed in between two patients? a. Yes b. No
15	Posters promoting hand hygiene are available and are displayed in the hospital. a. Yes b. No
16	Do you feel alcohol based hand rub should be available at the point of care? a. Yes b. No
17	Hand Hygiene is indicated in which condition. a. Before and after touching a patient b. After body fluids exposure c. Before aseptic procedure d. All of above
18	What is the required time for proper hand wash? a. 5 sec. b. 10 sec. c. 15-20 sec. d. 40-60 sec.

19	What is the required time for surgical hand washing? a. 2-3 min. b. 3-5 min. c. 15-20 min. d. 30 min.
20	Is the hand washing done before and after any procedure e.g. Collecting lab samples, examination of the patient, handling blood and body fluid? a. Yes b. No
21	Have you been informed and trained for bio-medical waste disposal? a. Yes b. No
22	Is the waste segregated at the site of generation.? a. Yes b. No
23	Are the disposable gloves and masks reused? a. Yes b. No
24	Shall you recap a needle before disposal? a. Yes b. No
25	Do you think that there is a need for categorization of waste management? a. Yes b. No
26	How many categories of bio-medical waste? a. 3 b. 4 c. 5 d. 6
27	Do you use needle hub cutter to prevent reuse of syringes? a. Yes b. No
28	Anatomical waste should be segregated in which colour bags? a. Red b. Yellow c. Blue d. White
29	Sharps should be segregated in which colour box? a. Yellow b. Red c. White d. Blue
30	All the bags used for waste collection need to be sealed once- a. they are filled to 1/4 of their capacity b. they are filled to 2/4 of their capacity c. they are filled to 3/4 of their capacity d. they are filled to 4/4 of their capacity
31	How much concentration of sodium hypochlorite used in spillage? a. 1% b. 2% c. 3% d. 4%
32	Cleaning and disinfection of surfaces and floor coverings- a. important b. not important
33	What should be done if lab request forms are spoiled? a. Change & discard b. Nothing c. Clean & Dry

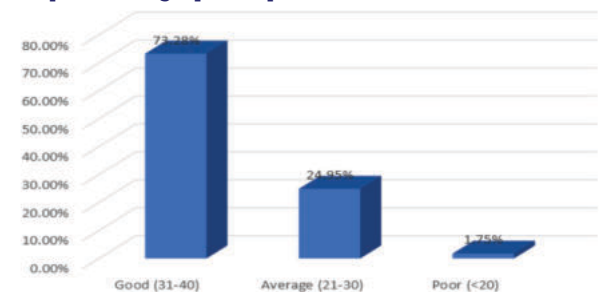
34	Shall medical waste containers to be disinfectant before re-using? a. Yes b. No
35	Which skin antiseptics used before collection of blood? a. Spirit b. 70% isopropyl alcohol c. Spirit, Iodine d. Spirit, Sodium hypochlorite
36	Full term of PEP? a. Personal exposure policy b. Post exposure prophylaxis c. Partial exposure policy d. Public exposure prophylaxis
37	Who should use PPE kit? a. Doctors b. Nursing staff c. Laboratory staff d. all of above
38	What is the PPE ?
39	Which vaccine should be given to all healthcare workers? a. Measles b. Rubella c. Hepatitis B d. BCG
40	Gloves, masks, and aprons are worn while handling contaminated linen? a. Yes b. No

RESULTS:

In the study, there were 569 health care workers included, among this 82 (14.41%) resident doctors, 37 (6.5%) intern doctors, 77 (13.53%) nursing staff, 78 (13.7%) laboratory technicians and 295 (51.82%) undergraduate medical students. There were 40 (forty) questions prepared and then responses to all questions were given a score, the KAP score.



Graph 1: - Category of Responders



Graph - 2: - Percentage of Good, average, and poor responses answered by, healthcare workers towards certain aspects of hospital-acquired infections and bio medical waste management.

The majority of healthcare workers had good knowledge, attitudes, and practices regarding hospital-acquired infections and bio-medical waste management. Graph 2

shows 73.28%(417) had good, 24.95% (142) had average and 1.75 % (10) had poor knowledge, attitudes, and practices among healthcare workers.

Table 3: - Category wise KAP score among healthcare workers

Category of HCWs	Good	Average	Poor
Resident doctor (n=82)	76 (92.68%)	6 (7.32%)	0
Interns (n=37)	36 (97.29%)	1 (2.70%)	0
Nursing staff (n=77)	64 (83.11%)	12 (15.58%)	1 (1.29%)
Lab technicians (n=78)	55 (70.51%)	20 (25.64%)	3 (3.84%)
Undergraduate Medical students (n=295)	186(63.05%)	103 (34.91%)	6 (2.033%)

Table 3 shows the highest level of knowledge, attitudes, and practices among intern doctors had 97.29%, followed by resident doctors 92.68%, nursing staff 83.11%, laboratory technicians 70.51% and medical students had 63.05%.

In this study, responses showed the highest knowledge, practices, and attitudes about universal precautions was 91.52% among all healthcare workers and then followed by personal protective equipment shown 86.9%, healthcare policy shown 84.52%, sterilization, disinfection, and linen management shown 84.22%, post-exposure prophylaxis, and vaccination shown 81.75 %, hand hygiene shown 78.8% and biomedical waste management shown 77.8%. So there was deficient knowledge, attitudes, and practices regarding hand hygiene and bio-medical waste management.

DISCUSSION:

In this study, responses showed that good years of experience in healthcare facilities were significantly associated with increased knowledge, attitudes, and practices among the various categories of healthcare workers. This study showed that the acceptance was maximum among residents and interns doctors and nursing staff, intermediate for technicians, and least for undergraduate medical students^[17,18].

To assess the knowledge, attitudes, and practices for the prevention of hospital-acquired infections, there were questionnaires prepared which cover different aspects like universal precautions, hand hygiene, biohazardous waste management, post-exposure prophylaxis and vaccinations, disinfection, sterilization and linen management, and hospital infection control policy^[18,19].

In the present study, the good KAP (knowledge, attitude, and practice) score was highest among resident doctors (92.68%) and intern doctors (97.29%) who were routinely practicing in the hospital, which was quite similar to Sangita Rajdev et al. (85.2%) study^[19]. And nursing staff had an 83.11% good KAP score, and they also had good compliance regarding nosocomial infections, which was similar to Gruda A. et al. showed an 83.53% good KAP score^[20]. The laboratory technicians had a 70.51% good KAP score, which is very promising than another study by Wader JV et al. had 53.71%^[21].

But in undergraduate medical students, the good KAP score was 63.05% and the average KAP score was 34.91% which showed, they had deficient knowledge, attitudes, and practices regarding hospital-acquired infections. Among these medical students, a good KAP score was shown in 3rd year (80.61%) and final year (96.29%) students because of more clinical exposure than 1st year (30%) and 2nd year (67.5%) medical students which were similar to K. Chauhan et al. study^[22]. This emphasizes the need for more seminars and training regarding hospital-acquired infections and bio-medical waste management in 1st year, and 2nd-year medical students and laboratory technicians.

Thus, continuous medical education (CME), efficient in-service training, monitoring, and evaluation of healthcare worker's practices play an important role in the implementation of universal precaution and infection control usage^[23]. CMEs and surprise visits help the medical field maintain competence and learn about new and developing areas of their field. So regular and structural continuing medical education (CMEs) helps new beginners' medical students (1st year and 2nd year), nursing staff, and laboratory technicians to gain knowledge about hospital-acquired infections and bio-medical waste management.

CONCLUSION:

In the present study, the average KAP score was observed in medical students and laboratory technicians, so regular seminars and training for hospital-acquired infections and their prevention can help in the retention of knowledge, attitudes, and practices. It is recommended that there should be written guidelines for HCWs in every institution. We should thoroughly evaluate the knowledge of healthcare workers for their safe healthcare practices via surprise pre and post-theory tests and practical examinations. Regular systemic monitoring and knowledge evaluation of infection control and bio-hazardous waste management help in implementing and improving strategies for the prevention of hospital-acquired infection.

Declarations:

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES: -

- Ananthanarayan and Paniker's textbook of microbiology. 10th edition; Edited by Reba kanungo, Orient Blackswan private limited; 2017; p.p 648-659.
- MEMBER STATES INFORMATION SESSION ON INFECTION PREVENTION AND CONTROL (IPC) 2022; by World Health Organization. Available from: https://apps.who.int/gb/MSPI/pdf_files/2022/03/Item1_07-03.pdf
- Apurba S Sastry and Sandhya bhattacharya- textbook of Essentials of medical microbiology, 3rd edition; edited by Deepashree R, Anand J, J.P. medical Ltd; 2021; p.p 229-240, 263-267.
- Patel, D.A., Patel, K.B., Bhatt, S.K. and Shah, H.S. (2011) Surveillance of Hospital Acquired Infection in Surgical Wards in Tertiary Care Centre Ahmedabad, Gujarat. National Journal of Community Medicine, 2011; 2, 340-345.
- Chugh TD, Delhi N. HOSPITAL INFECTION CONTROL – ARE WE SERIOUS? 2012. Available from: http://www.apiindia.org/pdf/medicine_update_2012/infectious_disease_14.pdf.
- Markwarth R, Saito H, Harder T, Tomczyk S, Cassini A, Fleischmann-Struzek C, Reichert F, Eckmanns T, Allegranzi B. Epidemiology and burden of sepsis acquired in hospitals and intensive care units: a systematic review and meta-analysis. Intensive Care Medicine. 2020 Aug;46(8):1536-1551.
- Bailey and Scott's Diagnostic Microbiology: A textbook for isolation and identification of pathogenic microorganisms. 14th edition; Edited by Forbes BA, Sahm DF, Weissfeld AS. St. Louis: Missouri Company; 2017:p.p.48-49, 1063.
- Ministry of Health and Family Welfare Government of India NATIONAL GUIDELINES FOR INFECTION PREVENTION AND CONTROL IN HEALTHCARE FACILITIES ;2020;p.p 21-28.
- Jawetz, Melnick & adelberg's Medical microbiology textbook, 26th edition; edited by Geo.F Brooks; Karen Carroll; Janet S. butel; Stephen A. Morse; Timothy A. mietzner; the McGraw- Hill Companies; 2014; p.p 753-754.
- Guidelines for Management of Healthcare Waste as per Biomedical Waste Management Rules, 2016.
- Waste Management Policy-Central pollution control board, CPCB, Delhi, 2022. Available from: <https://www.ntpc.co.in/sites/default/files/downloads/Waste-Management-Policy-2022.pdf>
- Haider S, Kumari S, Kashyap V, Sunderam S, Singh SB. A study on knowledge and practice regarding biomedical waste management among staff nurses and nursing students of Rajendra Institute of Medical Sciences, Ranchi. Indian J Community Health. 2015 Mar. 31; 27(1):135-8.
- Patil AD, Shekdar AV. Health-care waste management in India. Journal of Environmental Management. 2001 Oct; 63(2): 211-20.
- Mathur V, Dwivedi S, Hassan M, Misra R. Knowledge, Attitude, and Practices about Biomedical Waste Management among Healthcare Personnel: A Cross-sectional Study. Indian J Community Med. 2011 Apr; 36(2):143-5.
- Abdel-Rasoul GM, Al Bahnsy RA, Mohamed OA, Abdel-Aziz AM, Mourad WS, Youssef MF. Effect of an educational health program on the knowledge, attitudes and practices of healthcare workers with respect to nosocomial infections in the National Liver Institute, Egypt. Menoufia Medical Journal 2016; 29:984-90.
- Baig M, Jameel T, Alzahrani SH, Mirza AA, Gazzaz ZJ, Ahmad T, Baig F, Almurashi SH. Predictors of misconceptions, knowledge, attitudes, and practices of COVID-19 pandemic among a sample of Saudi population. PloS one. 2020 Dec 9;15(12): e0243526.

17. Gershon RR, Vlahov D, Felknor SA, Vesley D, Johnson PC, Delclos GL, Murphy LR. Compliance with universal precautions among health care workers at three regional hospitals. *American J Infection Control*. 1995 Aug;23(4):225-36.
18. Suchitra JB, Devi NL. Impact of education on knowledge, attitudes and practices among various categories of health care workers on nosocomial infections. *Indian journal of medical microbiology*. 2007 Jul 1;25(3):181-7.
19. Rajdev S, Mullan S. Assessment of knowledge, attitudes & practices among doctors, Nurses & ward aids on nosocomial infections in tertiary care hospital. *IP International Journal of Medical Microbiology Tropical Disease* 2019;5(4):222-225
20. Gruda A, Sopjani I. The Knowledge, Attitudes and Practices of Nurses Toward Management of Hospital-acquired Infections in the University Clinical Center of Kosovo. *Mater Sociomed*. 2017 Jun;29(2):84-87.
21. Wader JV, Kumar V, Mutalik AV. Knowledge, attitude, practice of biosafety precautions amongst laboratory technicians in a teaching hospital. *International Journal of Health Science and Research*. 2013;3(6):28-33.
22. Chauhan K. Knowledge attitude and practice towards infection control measures amongst medical students in a medical teaching tertiary care hospital. *International Journal of Clinical Medicine*. 2017 Sep 29;8(09):534.
23. Janjua NZ, Razaq M, Chandir S, Rozi S, Mahmood B. Poor knowledge — predictor of nonadherence to universal precautions for blood borne pathogens at first level care facilities in Pakistan. *BMC Infectious Disease* 2007;7:81.