CHAPTER II

REVIEW OF LITERATURE

Review of literature is an important source of development of research project. It helps to get detailed information and deep insight regarding research problem and provide information of what has been done previously. It helps the researchers to be familiar with the present studies and provide basis regarding development of methodology, tool for data collection and research design.

Literature reviewed for the present study has been discussed under the following headings:

2.1 Literature related to Need and Importance of Biomedical waste management.

2.2 Literature related to Infection prevention and Occupational exposure posed by biomedical waste.

2.3 Literature on studies related to knowledge of nurses regarding BMW management.

2.4 Literature on studies related to practice regarding BMW management.

2.5 Literature on Studies related to knowledge and practice regarding BMW management.

2.6 Literature related to effectiveness of orientation programme on BMW management
2.1 Need and Importance of Biomedical waste management

Effective and efficient methods of Biomedical Waste Management should be employed to prevent harm to human and environment. Injuries due to improper waste management may lead to infections to healthcare workers and waste handlers. Hospital acquired infections can spread due to poor practices of infection control and waste management. To prevent hazardous effects of BMW, an efficient and technologically safe economically and culturally acceptable method of hospital waste management is to be identified.27

An observational cross sectional study in a tertiary level hospital at Puducherry among 337 health care personnel by using a semi structured questionnaire was carried out. The results revealed that <50% of nursing staff and <25% of MPWS had the knowledge of color coding and segregation. Poor knowledge regarding disposal of sharps was observed, and had good knowledge regarding disease transmission through improper biomedical waste handling. The study again revealed that there was a need for continuing training programmes on BMW and administration needs to put protocols, by providing required resources for practicing bio-medical waste management as per rules.28

Case study conducted in a health care facility with 550 beds, 42 wards and 20 OPDs associated with a medical college generated 0.5-2 Kg. waste/day/bed. Overall generation of waste was 687 Kg./day out of which 71.6 Kg sent for incineration and 120 Kg sent for landfill. Only 192 Kg of waste need to be take care with additional precautions. No infectious waste was stored beyond 24 hrs. Study concluded that pathogenic waste, sharps and infectious waste can be send for plasma pyrolysis, were no additional treatment is required for leftover and will be useful to safeguard the environment.29

A study on evaluation of awareness programme on practices of bio-medical waste management at leading hospital in Ahmadabad among hospital staff revealed that conduction of training workshops on bio medical waste management for hospital
staff has shown providing results in practicing bio medical waste management. The study recommended periodic training workshops on bio medical waste management to reinforce and improve knowledge of health care workers for proper implementation and management of bio medical waste.30

A cross sectional study to assess awareness of bio medical waste management among 116 medical staff, 72 staff from paramedical and 58 from sanitary staff of a teaching hospital, M.P, concluded that awareness of hazards associated with bio medical waste management and handling was 95.83%, prevention of hazards(93.05%), color coding(61.1%), segregation(51.38%), transportation, open unused sharps are not considered as bio medical waste(41.67%), knowledge regarding storage (43.05%), about total waste generated in a hospital is hazardous(25%). The study concluded in service education to nursing staff for improvement in knowledge and practice.31

A study on awareness regarding biomedical waste management among doctors, paramedical staff and non medical staff in a district of MP, revealed that practices of waste management in hospitals were grossly inadequate. The study recommended orientation and re-orientation training programmers for health care workers and strict implementation of guidelines in a strict manner of BMW management to protect themselves and hospital visitors.32

A KAP study on bio-medical waste management of the staff at a tertiary level hospital and observed that, the laboratory staff was found to have recorded lowest in all the three aspects. The findings showed that they never informed the staff in the form of guidelines or instructions and not supervised their Bio-medical waste management practices. On further processing and analysis it was observed that the laboratory technicians and nursing staff showed least of interest to know more about the system of bio-medical waste management and they expressed that it is the responsibility of hospital management providing direct patient care. The study respondents felt need for training and publicity of the issue.33
2.2 Infection prevention and Occupational exposure posed by BMW

A cross sectional study focusing on awareness of health workers regarding hospital waste management in health care facilities which was focused on CPCB rules training status, maintenance report and accident reporting system among 71 health care facilities. It was observed that of the 71 health care facilities under study 42.2% of health care facilities were registered with SPCB only 4.2% of health care facilities had trained staff, 39.4% of all health care facilities were maintaining reports related to waste management and none of the facilities had occupational exposure reporting system. The present study revealed gross inadequacies in most of the health care facilities regarding proper waste management system.\textsuperscript{34}

A study conducted as management & universal precaution regarding BMW among health care personnel working in a PHC area found that that only 33.3% respondents knew that there is a legislation regarding the management of bio-medical waste. Only 85.71% were aware of the common types of wastes disposed and 82.5% were able to identify color codes of bins for waste disposal. Only 53.9% had proper knowledge regarding all the ten categories of biomedical waste. Correct knowledge regarding Universal Precautions was found among 57.14% health care personnel. Only 39.7% were following safe injection practices and all respondents (100%) were vaccinated for prevention of Hepatitis-B. Awareness of PEP against HIV was among 50.79%. Only 52.3% were having knowledge regarding spillage of body fluids and its management. In a total of 63 health care personnel 33.33% participants underwent training on bio-medical waste management at least once previously, the necessity of training with a periodic follow-up and monitoring was highlighted.\textsuperscript{35}

A study was carried out on knowledge, attitude, and Practices existence among doctors and nursing staff in a teaching hospital showed that the existence knowledge of regarding BMW (management & handling) rules was higher among doctors (68.5%) than in the other categories, none of the sanitary staff were aware of bio-medical waste rules. A majority of the nurses (73%) could identify the biohazard symbol unlike others. The doctors had better knowledge about all the aspects of bio-
medical waste management compared to other categories but regarding disposal of sharps in blue container was found less, puncture proof containers (31%) in which other categories had better knowledge. Only 16% of the sanitary staff was aware of the diseases transmitted by bio-medical waste. Practice regarding BMW management revealed that majority of the nurses and lab technicians had favorable practices than the other groups, particularly the practice of disposing sharps in blue colored puncture proof containers. One of the important risk factors for needle stick injuries was high among nurses and paramedical staff and found highest among physicians (70%) due to recapping of needles. However, injury reporting was low across all the categories of health care workers. The knowledge of doctors was better compared to their practices whereas poor for nursing staff and laboratory staff. Knowledge level was low on all counts among sanitary staff; one of the important risk factor for NSI was found high (67%) among all three groups. This may be contributed to poor awareness, also informal consultations revealed lack of adequate number of needle cutters in the hospitals.36

A descriptive study on knowledge and awareness of needle prick injury among dental college students, Maharashtra, India revealed that 74% students knew that needle stick injuries result in contact of blood-borne infection like Hepatitis B virus (HBV), Hepatitis C virus (HCV), and HIV. Regarding awareness of students towards management of needle stick injury, the overall average percentage of correct response was 91.55%. About 89% of participants agreed that Post-Exposure Prophylaxis (PEP) should be initiated within a period one hour of the exposure. A majority (96%) of participants believed that most injuries occurred during disposal of sharp and higher (96%) of participants were aware that blue bag is used for disposal of waste sharps. The study also revealed that injuries from sharp objects and used needles among healthcare workers were a widespread occupational hazard.37

A study on NSI among nurses working in Imam Hussein Hospital observed that the nurses were frequently exposed to blood-borne infection. NSIs were highly prevalent among these nurses. The causal devices in 105 cases (92.1%) were hollow-bore needles and the main causes of percutaneous injuries with hollow-bore needles
recapping (32.4%) and manipulating needles in patients (18.1%). The majority (51.8%) of injuries occurred after use and before disposal of the items.  

2.3 Studies related to knowledge of nurses regarding BMW management

Study conducted on KAP on BMW management among health care professionals in Coimbatore Medical college hospital, Tamilnadu. The findings of the study stated that young doctors and nursing students have good knowledge than others as they have BMW management in their curriculum. They have scored an average knowledge of 7.99 for doctors followed by 7.80 by nursing students. The nurses had scores of 7.60 and lab technician 7.55 out of 10. The results of ANOVA indicated that knowledge is not uniform among individual group with a mean score of 4.057. The study also concluded that for effective implementation, continuous training programme is mandatory to improve knowledge, attitude and practice.

A cross sectional study to assess the knowledge about biomedical waste management among 100 health care professionals in a tertiary care teaching hospital, Mangalore among nurses, class IV, L.T, pharmacists and radiologists. The findings showed that the total pre test and post-test mean knowledge score of the nurses and doctors were 46.23% and 79.93% respectively. The pre-test mean knowledge score of doctors (55.3%), nurses (45.7%), other (47.8%) and class IV (36.1%). Similarly the post-test mean knowledge score of doctors (88.8%), nurse (87.9%), others (80.7%) and class IV (62.3%) respectively.

A descriptive survey was carried out in Udaipur, Rajasthan among 120 nursing students to assess the knowledge regarding biomedical waste management using structured knowledge questionnaire. The results revealed that the knowledge of respondents regarding waste management and handling rules was 84.17%, segregation of waste 63.3%, source of origin of BMW 57.5%, treatment of BMW 54.58% and the least percent of knowledge was found 45.83% regarding disposal of waste. The findings also depicted that overall mean percentage of knowledge among
respondents was 61.67%, moderate level of knowledge was 33.33% and low level of knowledge was only 5% among nursing students of selected nursing colleges.\textsuperscript{41}

A descriptive study conducted at RIMS Ranchi among 240 nursing staff and nursing students revealed that knowledge regarding general information was better among nursing students (65%) than staff nurses (33.33%). When the practical information regarding BMW management was assessed, it was concluded that the nurses were having better practice than students as they scored 30% only. The study concluded that though overall knowledge of study participants was good but still they need good quality training to improve their current knowledge and practice regarding BMW.\textsuperscript{42}

In a study on biomedical waste management and handling at district Puiwama, it was observed that lack of knowledge, lack of efficient and proper management system of BMW, lack of training, poor awareness among employees and ignorance of hospital administrators for management and disposal of hospital wastes are points which need to be addressed in earnest. They further felt that there was a gap between bio-medical waste rules and their application in real field. There was a need for awareness among employees, common masses regarding 100% successful implementation of biomedical waste rules.\textsuperscript{43}

A KAP study about biomedical waste management among personnel of a tertiary health care institute in Dakshina Kannada, Karnataka revealed that knowledge regarding bio-medical waste management was poor among all health workers including lab-technicians, nurses, physicians and class IV waste handlers. Only a small fraction of study respondents were unaware about the BMW which is infectious constituted less than 25% of the total hospital waste. Most of the doctors (98%) and nursing staff (70%) had good awareness regarding segregation of biomedical waste has to be done at the point of generation. Correct response about potential for transmission of diseases through bio-medical waste was adequate in all the groups except class-1V. None of the needle stick injuries were adequately
treated. This was because of lack of reporting to seniors and concerned authorities led to inadequate treatment of the reported injuries.\textsuperscript{44}

A study conducted on knowledge of hospital waste management among nursing personnel of GTP Hospital, New Delhi revealed that 66.6\% of the staff nurse was aware about generation of bio medical waste and 77.5\% categorization and segregation. 92.22\% of the staff nurses aware of the transport and 66.66\% aware about the treatment and final disposal of biomedical waste and 70\% awareness about the needle disposal. 99.66\% of the nursing personnel desired the hospital authority to conduct training programmes regarding the awareness of bio medical waste management.\textsuperscript{45}

A cross sectional study was conducted in 8 surgical departments of faculty of Nursing, Mansoura University, Egypt. Among different categories of HCW including 38 doctors, 106 nurses, and 56 housekeepers, data were collected using a self-administered knowledge questionnaire for nurses and doctors and an interview schedule for housekeepers. Observation checklist was used for assessment of performance. Only 27.4\% of nurses, 32.1\% housekeepers and 36.8\% of the doctors had satisfactory knowledge. Concerning practice, nurses had practice scores 18.9\%, 7.1\% for the sanitary staff, and doctors had adequate knowledge.\textsuperscript{46}

A cross sectional study on knowledge, attitude and practice in tertiary care institution of Kolkata among 334 teaching and non teaching nursing staff out of which 180 were from clinical side and 154 were from teaching side. The study concluded that 94.4 \% teaching staff and 80 \% nonteaching staff were conscious about safe collection and final disposal of biomedical waste. The teaching staff was having more knowledge comparing to nonteaching staff.\textsuperscript{47}

A cross sectional study was conducted among to assess knowledge of hospital waste management in 336 tertiary care hospital staff, Bareilly, U.P. which included 18 nursing in-charges, 210 nurses, 72 lab technicians and 36 front office executives. The result concluded that more than 90\% knowledge was found in areas like BMW
management rules, categories of waste, color coding, segregation of waste, disposal methods and bio hazard symbol. Poor knowledge was found in areas like use of PPE and spread of disease due to BMW management. Among nurses the least percentage (41.4%) of knowledge was found regarding methods of disposal. Knowledge was higher among nursing in charges. There was no proper segregation, storage & transportation system of BMW.48

Study conducted on health care personnel revealed that significantly more nurses than physicians correctly disposed of blood-contaminated fomites (84.8% versus 62.7%) and correctly disposed of general waste (81.5% versus 69.1%). Moreover, the percentage of nurses showing satisfactory overall practice scores (84.8%) was significantly higher than that of physicians (67.3%). It was found that duration of work experience and having ever received training on waste management were not significantly related to satisfactory scores in any of the studied domains among physicians and housekeepers, and training was not related to KAP scores of nurses (F> 0.05). The only significant variable was lifetime work experience among nurses; more of those who had worked 2 years had satisfactory knowledge scores (68.7%) than those who had worked < 2 years (47.3%).49

2.4 Studies related to practice regarding BMW management

Study conducted among 176 nurses in a tertiary level hospital, Udaipur, Rajasthan to assess BMW management practices adopted by Para-medical staff revealed that only 79% of respondents knew about BMW legislation, 57% were having knowledge on hazardous waste, 54% were having knowledge on categories of waste and 58% knew the various methods of disinfection. 74% participants experienced NSI 2-3 times in last year. 71% had reported to the NSI to concerned authorities. Almost 98% of participants agreed that nurses should get orientation and training programmes to update their knowledge.50

A study to assess the knowledge on bio medical waste disposal among the 40 group D health workers of Uttarakhand showed that group D health workers had
22% average knowledge and 78% good knowledge regarding the biomedical waste disposal. The study recommended monitoring and supervision as the important component for improving the knowledge of group D workers.\textsuperscript{51}

A Cross sectional study on awareness and practices regarding BMW management among 105 health care workers including doctors, nursing staff and para-medical workers in a teaching hospital at New Delhi. The results of the study revealed that only 17% of HCW were aware of the categories of BMW. 47% had knowledge regarding definition, 62.44% were unaware regarding mercury waste disposal, and knowledge regarding BMW guidelines was 85%. Awareness was found least (73%) among doctors as compared to nurses who were having good awareness (96.15%) the study recommended an urgent need for raising awareness on BMW management among hospital staff in all health care setups.\textsuperscript{52}

A study on Health care waste management practices among healthcare workers in healthcare facilities of Gondar town, Northwest Ethiopia concluded that majority of healthcare workers did not practice healthcare waste management. They recommended, providing adequate numbers of waste bins, regular training and supervision on healthcare waste management to improve the problems of poor management of healthcare wastes.\textsuperscript{53}

A study conducted on knowledge, attitude and practice among staff of a trauma centre level II in KGMC, Lucknow found that knowledge, attitude and practice had no correlation, although 96.4% nurses had knowledge of bio-medical waste management and 92.8% had positive attitude towards it and only 85.7% nurses and 71.4% OT staff were practicing it adequately according to the guidelines.\textsuperscript{54}

The awareness and practice of HCW in a medical college hospital in Bangalore observed that the Knowledge about biomedical waste management rules among personal who were technically qualified like physician, nursing staff, and laboratory attendants was satisfactory but was less among the sanitary staff and housekeeping personnel. The nursing staff had significantly positive attitude when
compared to the laboratory technicians and the staff of housekeeping (P<0.05). On the other hand the practice of reporting of injuries resulting from improper disposal of hospital waste was found to be completely absent among them.\textsuperscript{55}

A study was conducted on awareness and practice on bio medical waste management among staff of the govt. SMHS hospital, Srinagar. Data was collected from doctors, nursing staff and para medical staff respectively. The positive and negative answers obtained were analyzed using t- test and chi- square test P value of, 0.005 was found significant. The findings of the study revealed that among doctors there was enough knowledge regarding awareness on management of bio medical waste and potential for risk of infection like hepatitis and AIDS. Positive response regarding the BMW management was 86% (P value= 0.005). It was found that there was significant awareness among nursing staff, which were found aware of potential health hazards of hospital waste. Correct response regarding the subject was 58% (P value = 0.05). However among paramedical staff correct answers regarding the subject was 11% (P value = 0.05). The findings revealed that the respondents were having inadequate knowledge about BMW management and poor concept among the paramedical personnel.\textsuperscript{56}

Yet another study conducted on Biomedical Waste Management stated that Plastic waste receptacles of different color codes were being used without any consideration of rules. No plastic bags were being used for lining plastic buckets / receptacles, plastic IV bottles, catheters and disposables were being mutilated physically and then either were sold to contractor or donated. No hospital safai karamcharis were found to be using complete protective equipments. In one hospital, wastes is physically checked by laying out the waste and manual segregation is carried out which can cause injury to the staff which should be avoided at any cost. Plastic buckets were in broken condition and not provide with new one. Hypochlorite solution was not used for sharps and proper segregation was not being practiced. The rag pickers were carrying plastic waste and sold them to contractors at hospital waste dump itself. The transportation of trolleys was used for various other purposes like
carrying linen and stores etc. Most of needle cutters were not functioning and it was mutilated manually which can prove to be dangerous for health care worker.57

In a study conducted on BMW among 53 Nursing Homes in Delhi revealed that there is a marked improvement in segregation practices of Biomedical Waste in small hospitals and nursing homes after getting training on BMW management. For the collection, disposal and management of hospital waste, they were using a service provider.58

2.5 Studies related knowledge and practice regarding BMW management

Study on awareness and practice about BMW management among health care workers in tertiary care hospital of Haldwani, Nainital among 384 health care workers revealed that 86% of nurses were aware of disease transmission, only 32.7% of all HCW had knowledge regarding disposal of plastic items. The difference among HCW was found maximum among nurses (47%) comparing to doctors (25.5%) which was found statistically significant. 70.9% of nurses had knowledge of disposal of soiled dressings whereas only 34.4% doctors had correct knowledge of the same. 65% of nurses had correctly responded for disposal of sharps, 89% of nurses were able to identify Bio Hazard Symbol. 95% of HCW were practicing PPE while handling waste and 65% reported practice of segregation of waste which was maximum (78.8%) among nurses. The study concluded that awareness and practice of BMW varied among different categories of staff which was not satisfactory. For effective implementation of BMW practices there is a need to sanitize the staff through training programmes.59

A study was undertaken among 6 doctors, 6 dentists, 10 paramedical staff and 6 graduate and postgraduate nursing students of Lucknow to assess the knowledge and practice regarding hospital waste management. The result showed that the knowledge about waste disposal and authorization found among the doctors (83.3%), dentists (50%), paramedical (80%) and students (66.7%). Among the participants 905 of nurses believed that BMW management is a team work. Practice level
assessment showed among doctors 83.3%, dentists 50%, paramedical 80% and students 33.3% were using autoclave and a lesser number were using dry heat sterilization. 60% of nurses practiced the measures for universal precautions.  

A qualitative and quantitative appraisal of nurses on BMW management and observed that their Mean knowledge score was 69.15% More than 90% of the nurses opined that proper hospital waste management is mandatory and could consider their vital role in it. 86% expressed the need of refresher training. Significantly, (P < 0.05) higher number of nurses in surgical specialty (98%) could identify their vital role in hospital waste management than the staff working in nonsurgical departments (85.7%). Workplace practice assessment showed that nurses were using gloves while nursing the patients and handling the waste. Four color containers (i.e. yellow, red, black, and blue) were kept and used in all the work stations for immediate reference. Charts indicating instruction in English language were displayed near the waste containers at work stations to aid nursing staff in proper segregation. All nurses were vaccinated against Hepatitis B by the hospital administration. They concluded that nurse’s knowledge was not satisfactory and refresher trainings were needed.  

A descriptive study conducted at RIIMS, Ranchi among 240 nursing staff and nursing students revealed that knowledge regarding general information was better among nursing students (65%) than staff nurses (33.33%). On assessment of practice regarding hospital waste management it was found that staff nurses had relatively better practice than students as they scored good (40%) whereas students scored 30% only. The study concluded that though overall knowledge of study participants was good but still they need good quality training to improve their current knowledge and practice about BMW management.  

Study on Biomedical Waste Management, “knowledge, attitude and practice among HCP at selected teaching hospital in Rajkot”, they found that Majority of participants had heard about the bio-medical waste and its management rule but less than half of the study participants had actually received refresher training on hospital waste management. 40.4% of study participants knew correct categories of
biomedical waste. However, overall knowledge of study participants was good but still they needed good quality training to improve their current knowledge about biomedical waste. They emphasized good quality training of health care personnel working in the hospitals at regular time interval.  

A study was undertaken to assess the knowledge and practice of biomedical waste management among 105 medical practitioners (post graduate practitioners and general practitioners) of Tamilnadu. The results revealed that 75% of practitioners were aware that some acts and rules are in existence regarding biomedical waste management. 55% of the practitioners agreed to segregate waste at the point of generation, 65.5% used color coding, while the remaining have their own system of segregation and it was also found that practice of segregation of biomedical waste was less among participants.

A study conducted to assess the knowledge, attitude and practice about BMW management among 237 nurses, 131 technicians and 132 housekeeping staff in the private hospitals of Karim Nagar, Andhra Pradesh showed that 95.8% of respondents had knowledge regarding occupational health hazards, categories of waste was found only among 1.6% of participants whereas only 45.4% of nurses had practiced BMW management. The researchers recommended a need for training program me to improve the knowledge and practice of nurses.

A study assessed KAP regarding “Biomedical Waste management among medical and Para medical staff in a tertiary care hospital” concluded that 20% of nursing staff have more than 70% knowledge, 60% nurses have a positive attitude towards biomedical waste management, and 65% of the nurses were doing correct practice (70%) as per norms. Although nursing staff have relatively poor knowledge about the hospital waste management rules than doctors, but a good percentage of this category had a positive attitude and follow the correct practicing habits.

A KAP study of paramedical staff on BMW management revealed that only 8 (1.6%) study subjects knew about categories of bio medical waste of which 5
(62.5%) were laboratory technicians. Total 353 (70.6%) study participants were having idea about segregation of bio-medical waste. Only 72 (14.4%) respondents had knowledge about various methods of disposal of bio-medical waste. Majority of the study subjects i.e. 479 (95.8%) had good knowledge regarding health hazards caused by bio-medical waste, of which 234 (48.8%) were nurses. The nurses had a better attitude toward separation of wastes 236 (99.5%), proper disposal 234 (98.7%), implementation of rules were followed by 233 (98.3%) and cooperation in programs were given 149 (62.8%) than other staff. In this study, better knowledge than the technical and housekeeping staff (P<0.001, x²=30.9) among nurses than significantly positive attitude was found among nurses when compared to the technicians and the housekeeping staff (x²=64, P<0.02, df=1) Regarding bio-medical waste practices, it was found that the nurses practiced bio-medical waste management better when compared to the technical and housekeeping staff and a significant difference was found (x²=9.48, P<0.01).67

A cross sectional study undertaken to assess knowledge, attitude and practice about BMW management among 273 health workers including doctors, nurses, I.T’s and sanitary staff. Results revealed that knowledge regarding different aspects of BMW management among nurses found was BMW rules 81%, color coding 83.3% and transmission of disease through BMW was found 81.6%. For practice areas disposal in proper containers 60%, disposal of sharps 56% and injury reporting due to improper disposal was 18.8%. The study recommended periodical trainings to update the knowledge and practice of nurses on BMW management.68

2.6 Effectiveness of orientation programme on BMW management

A descriptive survey among health care providers working in PHC’s of Bagepally Taluk, Mysore with a view to prepare an information booklet. Findings revealed that there was a lack of knowledge and awareness and improper practice of hospital waste among health workers and hence exposing themselves and the public to health hazards. Only 24% of health workers were having good knowledge while 35% were had good practice and 59% of respondents were practiced safety measures.
83% of HCW did not have any in service education on BMW Management. The study recommended that care providers, supporting staff, housekeepers and transport personnel responsible for must have periodic educational updates on BMW management for handling infectious and non-infectious waste. Nursing protocols should be developed and followed for BMW Management.69

A study undertaken at Dental college, Jaipur to assess the awareness of biomedical waste management, policy and practices among 144 hospital staff at Jaipur in which 50 dentists, 52 nurses, 20 lab technicians and 22 class IV employees were included. Results showed that there was a poor level of knowledge and awareness of biomedical waste generation hazards, legislation and management among health care personnel. Results were categorized into excellent, good to average and poor knowledge. According to this category, excellent knowledge was found 30% among doctors, 14% nurses, 15% lab technician and 5% class IV. Good to average knowledge included 45% doctors, 50% nurses, 45% lab technicians and 50% class IV. Poor knowledge included 25% doctors, 36% nurses, 40% lab technicians and 45% class IV. The study recommended inservice training programme for better result.70

A cross sectional study among nursing staff in Udupi city to assess the KAP regarding biomedical waste management revealed that 95.8% of respondents were agreed for segregation at the point of generation, 77.5% of study participants had knowledge about various disease transmissions through biomedical waste. The study revealed that for better hospital care management and implementation, regular training and supervision is necessary among health care personnel.71

A study on “Knowledge, attitude and Practices about Biomedical Waste management among Nursing Personnel of SKIMS Medical College Hospital, Bemina” concluded that knowledge regarding biomedical waste rules, segregation of waste, color coding of waste containers at source, disinfection of hospital waste before final disposal & disease transmission through hospital waste was very good among the nursing staff of this hospital. 70% of participants practiced correct
disposal of sharps in prescribed containers whereas 30% were reporting the injuries due to improper disposal of sharps. They further concluded that Regular training and awareness generation activities among the nursing staff are to be conducted to increase the KAP up to 100% level among nursing staff. Nursing protocol should be made for handling infectious and non-infectious wastes, set nursing protocols should be developed, adequate supplies and equipments should be available in all the departments to take care of waste properly. Injury reporting in the hospital needs to be established and practised.72

A study conducted among 63 HCP in a PHC with 25 SC in Krishna district, Uttar Pradesh to assess BMW management and universal precautions among health workers revealed that only 33.3% of HCP knew about legislations regarding BMW, 44% workers were able to define BMW, awareness of common types of waste was found among 54%, 26% knowledge about occupational hazards, 52% of HCP identified color coded bags, 26% had correct knowledge on the universal precautions and only 18% were practicing it properly. Difference between knowledge of trained and untrained HCP was found but not statistically significant.73

A review study was undertaken on “Importance of structured training key in successful BMW management in hospital” to find out the impact of training on knowledge level among HCP. Study was conducted among 184 staff out of which 55.7% male and 48.4% of the female participants reported that they never undergone any training on BMW management. 21.8% had lack of scientific attitude towards BMW management. 18% reported that there were insufficient resources for proper management of BMW. 29.5% had reported insufficiency of knowledge. The training of 60 hours was imparted in batches of 20 in the form of lectures and demonstration on practical aspects. The results concluded that knowledge levels of participants were increased as an outcome of training.74

A study conducted at Coimbatore Medical College on BMW management concluded that although nurses and LTs had a good knowledge score, 7.60 and 7.55 respectively but nursing students who had biomedical waste management in their
curriculum had more knowledge than others. Moreover, knowledge on biomedical waste management through waste management program like PUSH project has improved the implementation of biomedical waste management in Coimbatore Medical College Hospital.\textsuperscript{75}

As per the report of the study by CDC (Center for disease control) Atlanta US “Hospital waste management” published on 26 February, 2010 edition in Hindu online, there was a possible exposure of HIV due to needle stick injuries which is about 8 lakh annually documented by the HCW.\textsuperscript{76}

A study conducted a Pre and Post training KAP study conducted among paramedical staff working in laboratories and observed that Paramedical staff though had very poor knowledge about the bio-medical waste Act and rules before training, but a good percentage of this category had positive attitude and practice habits and their knowledge improved after the training. They stressed the essentiality of continuous in service training.\textsuperscript{77}

A pre experimental study was conducted to determine the effectiveness of SIM on bio medical waste management. 30 staff nurses were selected in Mangalore, Karnataka using multistage random sampling technique. The study concluded that majority (90\%) of nursing personnel had average knowledge regarding hospital waste management in the pre- test whereas 93.33\% of nursing personnel had good knowledge level in post- test.\textsuperscript{78}

A cross sectional study conducted in Allahabad city to assess knowledge, attitude and practice among the doctors (75), nurses (60), lab technicians (78) and sanitary staff (70). The study revealed that 95 \% nurse, 88.18\% lab technicians, 72.38 \% doctors and only 30.03\% sanitary staff had good knowledge about bio medical waste management, colour coding and disposal.\textsuperscript{79}