REVIEW OF RELATED LITERATURE

Studies conducted in India

1. AD Patil, AV Shekdar (2001) in their study titled “Health-care waste management in India” assert that biomedical techniques presently used can be improved for better environmental safety by developing awareness, financial management, and proper health care planning. In the research study a biomedical waste-management plan to be implemented by hospitals is also suggested, which includes collection and disposal arrangements, appropriate technological advancement, operational strategies, financial planning and the related staff training programmers.

2. Das and Prasad (2001) studied biomedical waste handling in study titled A TQM approach to implementation of handling and management of hospital waste in TATA hospital. Their finding suggests that 23% of waste generated properly and only 45% of staff was aware about proper handling methods of biomedical waste. Disposal of Hospital waste is of paramount importance because of its infectious and toxic nature. The study suggested to implement a proper plan of action for proper and timely disposal of biomedical waste.

3. Rao, Ranyal, Bhatia and Sharma (2003) studied about biomedical waste management in govt, Private, Charitable hospitals. In their study titled Biomedical Waste Management: An Infrastructural Survey of Hospitals, it was found that cost is one of the major issues for proper biomedical waste management. The findings of study suggest that there is an urgent need to regulate the infrastructural condition so that hospitals will be encouraged to follow biomedical waste management rules firmly without suffering additional costs.

4. Ray, Mukherjee, Roy Choudhary and Lahiri (2004) attempted to study the causes of respiratory disorders and other health related problems of ragpickers in Delhi. In their study titled Respiratory and general health impairments of ragpickers in India, it was observe that these individuals suffer from common diarrhea, gum related issues and skin infections to very serious diseases like metaplasia, inflammation of respiratory organs etc. which may be associated to their occupation. Properly undisposed biomedical waste is causes of these infectious diseases.

5. Pundit, Mehta and Kartha (2005) in their study “Management of bio-medical waste: awareness and practices in a district of Gujarat” suggest that as the level of responsiveness is not much in staff as well common public of it is essentially important in favor of humans and environment to increase the level of awareness.
about biomedical waste management and handling among healthcare workers as well common people in rural areas to control damage to population due to biomedical waste.

6. **Patil and Pokharel (2005)** conducted their case study titled *Biomedical solid waste management in an Indian hospital: a case study*” gave their findings that the related staff was well trained to take precautionary measures for handling biomedical waste and the hospital was well equipped and found to be fully complying with biomedical waste handling rules. It was also found that the hospital was extending its support to other hospitals neighborhood for handling the biomedical waste, generated by them.

7. **Mehta, Kartha and Choudhary (2005)** studied about biomedical waste handling in various private and government hospitals of Gujrat found that none of the doctors who were surveyed had proper knowledge about types of biomedical waste and their various treatment methods. Therefore, the disposal of biomedical waste was being done in inappropriate way which can be dangerous to health of environment. There was recommendation for including biomedical waste and its handling in medical curriculum.

8. **Gupta and Boojh (2006)** in their research article report “**Biomedical waste management practices at Balrampur Hospital, Lucknow, India**” studied about waste management practiced in Balrampur hospital of Lucknow and asserted that there is an urgent need for strict enforcement of legal provisions for biomedical waste disposal and to increase awareness in healthcare workers about harmful impacts of unsafe disposal of biomedical. The biomedical waste is not treated and disposed off in effective way thus it may be causing various health related issues in human population.

9. **Hedge, Kulkarni and Ajantha (2007)** analyzed various types of wastes and their management with special reference to dental waste management in their study titled *Biomedical waste management*. Their findings suggest that there was poor awareness, lack of motivation and financial issues involved which were hurdles in proper biomedical waste handling. It was suggested that there is an urgent need of staff awareness program me for proper and efficient management of biomedical waste and its handling.

10. **Sarogini, Jayanthi, Venkatraman and Prashnthini (2007)** studied Common biomedical waste treatment facility and safe disposal of biomedical waste. The
study was conducted in more than 250 hospitals of Coimbatore and nearby areas. Their findings suggest that the certain biomedical waste generators do not adhere to the rules prescribed by authorities for safe handling of biomedical waste and labelling was not done of containers carrying biomedical waste. There was lack of coordination between waste generators and treatment facility personals.

11. Rao (2008) studied biomedical waste management in three Indian states and gave his findings in his article “Report: Hospital waste management—awareness and practices: a study of three states in India” asserts that awareness levels about biomedical waste management is lower in rural areas in comparison with urban areas. Due to this there is need of enhancement of level of awareness in rural areas by various methods.

12. Radha, Kalaivani, Lavanya (2009) studied about various techniques of biomedical waste handling in their study titled A Case Study of Biomedical Waste Management in Hospitals” assert that there are poor biomedical waste management techniques which are followed in health care units and various shortcomings which can be rectified by introducing training programs, making policies, plans and protocols to ensure proper and timely waste management.

13. V. Gautham, et.al. (2010) in their study titled “Biomedical waste management: Incineration vs. environmental safety” state that incinerator emissions are injurious to health of environment as ashes generated during this are hazardous and can cause environmental pollution. Thus, there is a need of development of techniques which are helpful in maintaining the environment clean and safe and help in reducing the pollution.

14. Shafee, et.al. (2010) in their article titled “study of knowledge, attitude and practices regarding biomedical waste among paramedical workers” assert that the staff of health care unit had insufficient knowledge about BMW management. It was observed that through guiding about harmful effects of biomedical waste optimistic attitude was found to be developing. The nurses of health care unit were having better knowledge about proper handling and management of biomedical waste in comparison to technical and housekeeping staff.

15. Sood and Sood (2011) performed a descriptive study related to biomedical waste produced in dental clinics and its disposal. In their study titled “Dental perspective on biomedical waste and mercury management: a knowledge, attitude and practical survey” it was suggested that there is need of effective education related to
harmful effects associated with improper and untimely waste disposal and handling of infectious waste. The study also revealed that sometimes if dental waste is not treated and disposed in safe and effective manner it may cause environmental pollution in immediate surroundings.

16. Mathur, et.al. (2011) in their research study titled “Knowledge, Attitude, and Practices about Biomedical Waste Management among Healthcare Personnel: A Cross-sectional Study” assert that lack of proper knowledge of handling biomedical waste impacts practice of waste disposal causing problems related to it. The importance of training regarding biomedical waste management needs to be understood at all levels of society. It was found that related staff was not aware about segregation process to be followed properly.

17. Kaur (2011) in his study titled “A comparative study on knowledge and practices of nurses regarding biomedical waste management in select government hospitals “assert that there is reasonable awareness about biomedical waste and its segregation among the staff nurses, there is need of development of infrastructure for segregation of waste in hospitals. The segregation should be done according to type of biomedical waste which will help in disposal and treatment.

18. Mausumi Basu, et.al (2012) conducted descriptive observational study, and interviewed 200 junior doctors of a tertiary care hospital of Kolkata to find out awareness levels. In their study titled Assessment of future physicians on biomedical waste management in a tertiary care hospital of West Bengal they state that medical care and waste handling staff was aware that improper management of biomedical waste may cause serious health hazardous problems, and awareness levels are moderately ok, still, intensive staff training program and monitoring of biomedical waste management at regular time interval by authorities is required.

19. Mathur, Patan and Shobhawat (2012) in their research titled “Need of Biomedical Waste Management System in Hospitals - An Emerging issue - A Review” studied about how biomedical waste is handled in hospitals and effects of improper management can cause various hazardous effects on environment. Their findings suggest that major issue in BMW management in hospitals is unsatisfactory levels of implementation of waste management regulations. This results in spread of communicable diseases. This research paper emphasises on need of proper hospital waste management system as of prime importance and essential component of quality assurance in hospitals and health care units.
20. Nagaraju B, et.al. (2013) discovered the lack of desired knowledge and awareness about biomedical waste and its management even among some health workers. In the study titled *A study to assess the knowledge and practice on bio-medical waste management among the health care providers working in PHCs of Bagepalli Taluk with the view to prepare informational booklet* findings suggest that this is leading to poor practices of health care waste management resulting in exposure to various communicable diseases causing damage to staff and public in general.

21. Chudasama, et.al.(2013) studied about biomedical waste handling practiced in hospitals of Rajkot, Gujrat district. In their study titled “*Biomedical Waste Management: A study of knowledge, attitude and practice among health care personnel at tertiary care hospital in Rajkot*” they suggest that lack of proper and sufficient knowledge of biomedical waste management impacts the proper disposal of waste causing hazardous effect on health and wellbeing of society.

22. Sharma, et.al. (2013) studied about knowledge and consciousness about biomedical waste in health care workers in their study titled “*Awareness of biomedical waste management among health care personals in Jaipur, India*” state that there was very poor level of knowledge and awareness about hazards caused by improper disposal of waste and thus regular check and training is of utmost importance.

23. Amruth and Vetrivel Cherian Sengodan, (2014) studied waste handling practiced in south India in their study titled “*Knowledge attitude and practice study on biomedical waste management among health care professionals and paramedical students in a Tertiary Care Government Hospital in South India*” state that due to low levels of awareness among the related staff there are chances of improper waste handling causing spread of diseases. Thus, responsiveness among healthcare workers and related staff should be improved by awareness programs and organizing such programs should be made mandatory to improve the biomedical waste management in health-care centers worldwide.

24. Kumar and Kumar (2014) examined about ways of biomedical waste management in their study titled “*A descriptive study on evaluation of bio-medical waste management in a tertiary care public hospital of North India*” as the waste management is of very much importance it is important that waste segregation, disinfection and proper disposal. The study suggest that emphasis needs to be given on ‘mutilation of recyclable waste’ and disinfection of waste’ by staff of health care units.
25. Abiatha and Dhanapa (2014) in their study “Biomedical waste management in rural areas using solar powered thermal autoclave technique” assert that improper management of biomedical waste in rural areas causes soil, air and water pollution resulting damage to healthy environment of villages. This may lead to contamination of soil which in turn causes damage to health of organism. The waste in liquid form can cause water contamination as well. As the villages fulfil our basic agricultural need, contamination in soil and water will definitely effect the quality of food produced.

26. Patil, et.al. (2015) studied biomedical waste management in rural areas in their study titled “Need of Biomedical Waste Management in Rural Hospitals in India” state that although Biomedical waste management in rural India is receiving attention due to stringent regulations now a day, much more is required to be done in this field as there are many deficiencies in the management of biomedical waste in rural areas. Awareness level is very low in rural population and segregation practices are not effectively adopted.

27. Haider, et.al. (2015) did the research study in Ranchi, Bihar about awareness and knowledge of biomedical waste handling practices in staff nurses. In their study titled A study on knowledge and practices regarding biomedical waste management among staff nurses and nursing students of Rajendra institute of medical sciences, Ranchi they assert that although the participants who were involved in study had overall adequate knowledge and scored well in questioners, they require good and quality training to improve their current knowledge about biomedical waste and its handling.

Studies conducted abroad

28. Aljabre (2002) studied about the plan and intend adopted by the biomedical waste management committee in King Fahad Hospital of Alhkobar, Saudi Arabia, for safe and timely disposal of biomedical waste. In his study titled Hospital generated waste: A plan for its proper management he states that the biomedical waste should be handled in well controlled way from the sources of generation to the final treatment. The study suggested that ways of biomedical waste collection, transportation and storage should be well-organized and hence should meet the set required standards required by the authorities. Planning, identification of problem, regular monitoring and constant feed backs play an important role in proper handling of biomedical waste.
29. Norsayani and Noor Hashmi (2003) did their study on threat faced by medical students through biomedical waste while performing various clinical activities in health care centers in Malaysia. In their research, titled Study on incidence of needle stick injury and factors associated with this problem among medical students, it was found that level of precaution that medical students follow is low and thus these students are at risk of needle related injury and blood-borne infectious diseases. Thus, definite preventive measures are advised to be taken by the management of the universities to minimize and avoid such cases.

30. Muhlich Scherrer and Daschner (2003) did their comparative study on biomedical waste management. Their study titled A Comparison of infectious waste management in European hospitals assert that most of the countries follow proper rules and regulations for infectious waste management however there is sometimes lack of management in case of collection of infectious waste and types collecting bins in hospitals of some countries. Through study it was also found that rules and regulations were different in different countries for infectious waste management.

31. Jang, Lee, Yoon and Kim (2003) studied biomedical waste management in reference with hazard to environment. The study gave an overview of management practices presently being followed in Korea which includes generation, composition, segregation, transport, and disposal. The findings of the study put an urgent need of minimization and recycling of waste control and removal of toxic air pollutants emitted in process of treatment and development of alternative treatment methods.

32. Smith, Wei, Zhang and Wang (2006) studied about occurrence, spreading, and various risk factors for needle stick injuries in China. Their study titled Needle stick and Sharps Injuries Among a Cross-Section of Physicians in Mainland China, findings state that these injuries are comparatively higher in health workers of China. Study suggests that preventive measures are of great importance for future as the injuries from sharps may become cause of spread of infectious diseases which may be a serious issue.

33. Soliman, and Ahmed (2007) studied about how improper and inadequate management of biomedical waste causes health related risk to workers, patients, community, and environment. In their study titled Overview of biomedical waste management in selected Governorates in Egypt: A pilot study they found that in Egypt where the study was conducted to assess the handling and treatment of biomedical waste in different healthcare establishments biomedical waste is
inadequately processed and improperly handled in hospitals due to the absence of written policies and protocols by authorities. The development of waste management policies, plans, and protocols are strongly recommended, in the study with essential training.

34. Pawary, et.al. (2007) studied Mismanagement of biomedical waste and its hazardous effects on environment. Their study titled Health and safety perspective on medical waste management in a developing country: A case study of Dhaka city, revealed that there is an utmost need for awareness, training, and development of positive approach for all the staff involved in biomedical waste management so as to reduce the risk of environment and health related risk.

35. Majumder, et.al. (2007) studied the biomedical waste management practices in Nepal. In their study titled Characterization, quantification and management situations medical waste in Nepal, investigation was conducted for seven to fifteen days. During the study information was also collected through consultations with related staff. It was suggested that application and introduction of strong policies and measures to properly manage biomedical waste is needed and was highly recommended is study.

36. Spence (2010) studied that When biomedical waste is improperly managed and disposed it may cause health hazard causing infectious diseases and other related issues. In the study titled the development of a model program for effective management of biomedical waste in the Caribbean: A review of barriers in public hospitals of Caribbean, the author asserts that the Biomedical waste is also generated in homes from the use of syringes or bandages. In Caribbean, there may be various causative factors which influence biomedical waste management. These factor include government rules and regulations, risks factors associated with biomedical waste management in hospitals, biomedical waste management in public vs private hospitals training of staff handling biomedical waste and guidelines regarding biomedical waste management and disposal.

37. Lakbala, Azar and Kamali (2012) studied about injuries caused due to undisposed sharp objects such as needles and surgical instruments, in their study titled “Needle stick and sharp injuries among house keeping workers in hospitals of Shiraz, Iran. The findings of study suggest that for minimizing the injuries and infections in health workers and staff, health care boards and hospital authorities and management
essentially needs to frame policies and depress the undue use of injections, and increase observance of health care staff to maintain required precautions.

38. Winfield, and Brooks (2015) did their descriptive study on medical waste management, including the common sources of waste production, governing and legislative authorities and handling and disposal methods presently in use. Their study titled Medical waste management – A review suggests that better training and education of healthcare staff and correct segregation of biomedical waste are major effective factors for efficient and timely waste management, and that further study is required to enhance and encourage minimum medical waste production so as to reduce damage to environment.

39. Udofia, et.al. (2015) studied about biomedical waste management in their descriptive study titled Solid medical waste management in Africa. They found that color codes for different types of wastes, labelling of collection bins, general awareness and training programs are common challenges in proper management of biomedical waste. This is major cause of concern with growing number of population in continent, thus there is urgent need of increasing awareness among health care workers and public in general about this issue.

40. Taghipour Mohammadyarei, et.al. (2014) studied treatment methods of biomedical waste in Iran. In the study titled On-site or off-site treatment of medical waste: a challenge they found that Practical condition for waste management indicates that medical waste treating and handling processes and systems have operation, maintenance and cost related problems. Proper planning and responsibility should be given to waste generating units for in time disposal to avoid environmental hazards.