INTRODUCTION

Biomedical waste/ hospital waste is any waste, which is generated during the diagnosis, treatment or immunization of human-beings or animals, or in research activities pertaining thereto or in the production or testing of biologicals. It includes wastes of medical or laboratory origin (e.g., packaging, unused bandages, infusion kits, etc.), as well research laboratory waste containing biomolecules or organisms. In the 1980s and 1990s, concerns about exposure to human immunodeficiency virus (HIV) and hepatitis B virus (HBV) led to questions about potential risks inherent in medical waste. Thus, hospital waste generation has become a prime concern due to its multidimensional ramifications as a risk factor to the health of patients, hospital staff and extending beyond the boundaries of the medical establishment to the general population.

Although very little disease transmission from medical waste has been documented, both the American Dental Association (ADA) and Centre for Disease Control recommend that medical waste disposal must be carried out in accordance with regulation. Hospital-acquired infections have been estimated at 10% of all life-threatening diseases in the South-East Asia region and have been identified as one of the indicators for the management of waste. Although there is increased global awareness among health care professionals about hazards and also appropriate management techniques, the level of awareness in India has been found to be unsatisfactory. Materials and Methods: The hospital based cross sectional study was carried out in Anil Neerukonda Hospital, Visakhapatnam. All the nursing staff (n=145) who studied either GNM and B.Sc.(N)course were included in this study. Results & Conclusion: Majority of the nurses belonged to the age group of 20-25 years. 89.7% nurses attended orientation training program on BMW. Overall, the knowledge, attitudes and practices toward biomedical waste management among the study respondents was satisfactory. Knowledge, attitudes and practices toward biomedical waste management were better among the nursing staff. Periodic assessment and regular teaching along with hands-on training programs with an emphasis on recent amendments in rules should be stressed to bridge the gap between knowledge, attitude, and practices.

BACKGROUND: Biomedical waste/ hospital waste is any waste, which is generated during the diagnosis, treatment or immunization of human-beings or animals, or in research activities pertaining thereto or in the production or testing of biologicals. Hospital-acquired infections have been estimated at 10% of all life-threatening diseases in the South-East Asia region and have been identified as one of the indicators for the management of waste. Although there is increased global awareness among health care professionals about hazards and also appropriate management techniques, the level of awareness in India has been found to be unsatisfactory.

Objectives

- To assess the knowledge regarding biomedical waste management among nursing staff.
- To study the attitude of the nurses towards biomedical waste management.
• To study the practices adopted by the nursing staff regarding biomedical waste management.

MATERIALS AND METHODS

The hospital based cross sectional study was carried out in Anil Neerukonda Hospital, Visakhapatnam. All the nursing staff (n=145) who studied either GNM and B.Sc.(N)course were included in this study.

The instrument is a vehicle that could best obtain pertinent data to the study and at the same time adds to the body of knowledge in the discipline. Based on the study objectives, the instrument was divided into 4 sections

Section A: Demographic data
Section B: Knowledge questionnaire (structured interview schedule).
Section C: Likert’s five-point attitude scale (structured interview schedule).
Section D: Observational check list

A structured interview schedule was made to assess the knowledge and attitude and observational checklist was used for assessing the practices regarding biomedical waste management. Permission was obtained from the institutional ethical committee of NRI Institute of Medical Sciences, Visakhapatnam. Permission was obtained from Medical & Nursing Superintendents of NRI Institute of Medical Sciences, Visakhapatnam. Consent was obtained from the study subjects.

Data entry was done using M.S. Excel and was statistically analysed using Statistical package for social sciences (SPSS Version 16) for M.S Windows. Descriptive statistical analysis was carried out to explore the distribution of several categorical and quantitative variables. Categorical variables were summarized with n (%). All results was presented in tabular form and are also shown graphically using bar diagram or pie diagram as appropriate.

Operational definitions:
• Knowledge: The level of awareness and understanding of nurses about biomedical waste management.
• Attitude: The specific view or opinion or behaviour of nurses regarding biomedical waste management.
• Practices: The level of utility of resources related to biomedical waste management.
• Nurses: Individuals who are professionally trained and are providing health care services to the client in health care institutions and in the community.

RESULTS

Majority of the nurses belonged to the age group of 20-25 years (60%) followed by 26-30 years (30.3%), 31-35 years (8.3%) and 36-40 years (1.4%). Males were 13.1% and females were 86.9%. Total years of experience was < 5 years in 76.6% nurses, 6-10 years in 22.1% nurses & 11-15 years in 1.4% nurses. Professional qualification was B.Sc Nursing in 55.2% nurses & general nursing and midwifery in 44.8% nurses. Designation was head nurse in 22.1% nurses & staff nurse in 77.9% nurses. 89.7% nurses attended orientation training program on BMW. Majority of the nurses involved in this study were working in wards (40.7%) followed by casualty (17.9%), ICU (17.9%), OT (15.2%) and OP (8.3%).

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Question</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>What is biomedical waste?</td>
<td>143</td>
<td>98.6</td>
</tr>
<tr>
<td>2.</td>
<td>What is the symbol of biohazard?</td>
<td>145</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>What is the major classification of waste?</td>
<td>93</td>
<td>64.1</td>
</tr>
<tr>
<td>4.</td>
<td>How the cytotoxic waste is generated?</td>
<td>70</td>
<td>48.3</td>
</tr>
<tr>
<td>5.</td>
<td>Why segregation of the waste is important?</td>
<td>106</td>
<td>73.1</td>
</tr>
<tr>
<td>6.</td>
<td>What is the ideal bin to dispose the waste?</td>
<td>107</td>
<td>73.8</td>
</tr>
<tr>
<td>7.</td>
<td>Which type of waste is collected in Red container with biohazard symbol?</td>
<td>130</td>
<td>89.7</td>
</tr>
<tr>
<td>8.</td>
<td>Which colour coded bin with biohazard symbol is used for anatomical and pathological waste?</td>
<td>117</td>
<td>80.7</td>
</tr>
<tr>
<td>9.</td>
<td>Which colour coded bin with biohazard symbol is used for disposal of glass items?</td>
<td>101</td>
<td>69.7</td>
</tr>
<tr>
<td>10.</td>
<td>Which colour coded bin with biohazard symbol is used for official type of waste?</td>
<td>92</td>
<td>63.5</td>
</tr>
<tr>
<td>11.</td>
<td>Which type of waste is discarded in green container with biohazard symbol?</td>
<td>97</td>
<td>66.9</td>
</tr>
<tr>
<td>12.</td>
<td>How will you discard the sharp materials?</td>
<td>122</td>
<td>84.1</td>
</tr>
<tr>
<td>13.</td>
<td>What is your responsibility if mixing of waste with yellow container?</td>
<td>77</td>
<td>53.1</td>
</tr>
<tr>
<td>14.</td>
<td>When the cover in the waste colour container has to be tied?</td>
<td>86</td>
<td>59.3</td>
</tr>
<tr>
<td>15.</td>
<td>How long the waste can be stored in hospital?</td>
<td>105</td>
<td>72.4</td>
</tr>
<tr>
<td>16.</td>
<td>Which route is preferred for transport of waste inside the hospital?</td>
<td>109</td>
<td>75.2</td>
</tr>
<tr>
<td>17.</td>
<td>What is the important aspect to be seen in the waste transport vehicle?</td>
<td>128</td>
<td>88.3</td>
</tr>
<tr>
<td>18.</td>
<td>What is the importance of shredding in waste disposal?</td>
<td>52</td>
<td>35.9</td>
</tr>
<tr>
<td>19.</td>
<td>Why autoclaving is important before disposal of syringes, tubes and gloves?</td>
<td>122</td>
<td>84.1</td>
</tr>
<tr>
<td>20.</td>
<td>What is pulverization?</td>
<td>102</td>
<td>70.3</td>
</tr>
<tr>
<td>21.</td>
<td>How the placenta is disposed?</td>
<td>56</td>
<td>38.6</td>
</tr>
<tr>
<td>22.</td>
<td>Which one should not be incinerated?</td>
<td>92</td>
<td>63.4</td>
</tr>
<tr>
<td>23.</td>
<td>How the incinerated ash is stored?</td>
<td>69</td>
<td>47.6</td>
</tr>
<tr>
<td>24.</td>
<td>Which type of waste should not be discharged into sewers?</td>
<td>117</td>
<td>80.7</td>
</tr>
<tr>
<td>25.</td>
<td>Which is the useful method for final disposal of liquid waste in rural and small health care institutions?</td>
<td>71</td>
<td>49</td>
</tr>
</tbody>
</table>
6. It is difficult to identify and categorize the waste
   - Strongly agree: 61, %: 42.1
   - Agree: 76, %: 52.4
   - Undecided: 7, %: 4.8
   - Disagree: 1, %: 0.7
   - Strongly disagree: -

7. Labelling over the waste will reduce confusion
   - Strongly agree: 86, %: 59.3
   - Agree: 47, %: 32.4
   - Undecided: 3, %: 2.1
   - Disagree: 9, %: 6.2
   - Strongly disagree: -

8. It is difficult to reduce the amount of waste produced in the hospital
   - Strongly agree: 72, %: 49.7
   - Agree: 52, %: 35.9
   - Undecided: 13, %: 9
   - Disagree: 7, %: 4.8
   - Strongly disagree: -

9. More colour containers may lead to mismanagement
   - Strongly agree: 49, %: 33.8
   - Agree: 67, %: 46.2
   - Undecided: 17, %: 11.7
   - Disagree: 12, %: 8.3
   - Strongly disagree: -

10. It is difficult to identify and categorize the waste
    - Strongly agree: 48, %: 33.1
    - Agree: 48, %: 33.1
    - Undecided: 19, %: 13.1
    - Disagree: 26, %: 17.9
    - Strongly disagree: 2, %: 1.4

11. Busy schedule may interfere with the disposal of waste
    - Strongly agree: 43, %: 29.7
    - Agree: 63, %: 43.4
    - Undecided: 31, %: 21.4
    - Disagree: 6, %: 4.1
    - Strongly disagree: 1, %: 0.7

12. Biomedical waste management is time consuming process
    - Strongly agree: 52, %: 35.9
    - Agree: 61, %: 42.1
    - Undecided: 19, %: 13.1
    - Disagree: 13, %: 9
    - Strongly disagree: -

13. Biomedical waste management needs more of expenditure
    - Strongly agree: 55, %: 37.9
    - Agree: 54, %: 37.2
    - Undecided: 23, %: 15.9
    - Disagree: 13, %: 9
    - Strongly disagree: -

14. It is difficult for the nurse to co-ordinate with other health team members in biomedical waste management because of positional hierarchy
    - Strongly agree: 47, %: 32.4
    - Agree: 60, %: 41.4
    - Undecided: 28, %: 19.3
    - Disagree: 9, %: 6.2
    - Strongly disagree: -

Table 3: Distribution of nurses based on the practices regarding biomedical waste management

<table>
<thead>
<tr>
<th>Sl.no</th>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Identifying and labelling infectious and non-infectious waste</td>
<td>138</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>%: 95.2</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Using yellow colour container with biohazard symbol is for anatomical</td>
<td>143</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>and pathological waste</td>
<td>98.6</td>
<td>0.7</td>
</tr>
<tr>
<td>3.</td>
<td>Using red colour container with biohazard symbol is for infected plastics</td>
<td>143</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>%: 98.6</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Using blue colour container with biohazard symbol is for infected glass</td>
<td>141</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>items</td>
<td>97.2</td>
<td>2.8</td>
</tr>
<tr>
<td>5.</td>
<td>Using black colour container with biohazard symbol is for Cytotoxic</td>
<td>117</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>waste, Expired medicines &amp; Chemical waste</td>
<td>80.7</td>
<td>18.6</td>
</tr>
<tr>
<td>6.</td>
<td>Using green colour container with biohazard symbol is for kitchen waste</td>
<td>125</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>%: 86.2</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Using white colour container with biohazard symbol is for non infected</td>
<td>74</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>plastics and general waste</td>
<td>51</td>
<td>49</td>
</tr>
<tr>
<td>8.</td>
<td>Using protective devices like gloves, gown, mask, cap, boot while handling</td>
<td>109</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>waste</td>
<td>75.2</td>
<td>24.8</td>
</tr>
<tr>
<td>9.</td>
<td>Closing the container soon after putting the waste</td>
<td>123</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>%: 84.8</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Disposal of sharps items</td>
<td>127</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Disinfect with chemicals</td>
<td>876</td>
<td>12.4</td>
</tr>
<tr>
<td>11.</td>
<td>Monitoring the package the waste when it is filled ¾ of the cover in the</td>
<td>126</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>colour coded bin</td>
<td>86.9</td>
<td>13.1</td>
</tr>
<tr>
<td>12.</td>
<td>Monitoring the internal transportation without spillage of waste materials</td>
<td>125</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>%: 86.2</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Involves in giving education on biomedical waste management</td>
<td>124</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>%: 85.5</td>
<td>14.5</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

The present study was a cross sectional study conducted to study knowledge, attitude and practices about Biomedical waste Management among nursing staff Anil Neerukonda Hospital, Visakhapatnam.

In this study, majority of the nurses belonged to the age group of 20-25 years (60%) followed by 26-30 years (30.3%), 31-35 years (8.3%) and 36-40 years (1.4%). In Amita et al.[11] 53.3% study subjects were under 25-30 years of age, 23.3% study subjects were in 31-35 years of age, 13.3% of study subjects were under the age group of 36-40 years, 10.1% of study subjects were above 41 years. In Tiwari SK et al.[12] mean age of participants was 21.54 ± 2.49 years.

In this study, males were 13.1% and females were 86.9%. In Tiwari SK et al.[12] males were 18.4% and females were 81.6%.

In this study, total years of experience was < 5 years in 76.6% nurses, 6-10 years in 22.1% nurses & 11-15 years in 1.4% nurses. In Amita et al.[11] 16.1 % study subjects had 0-1 years of professional clinical experience, 30.2% of study subjects had 1-3 years of professional clinical experiences, 13.2 % of study subjects had clinical experience of 3-5 years, 40% of subjects had experience of more than 5 years.

In this study, professional qualification was B.Sc Nursing in 55.2% nurses & general nursing and midwifery in 44.8% nurses. In Amita et al.[11] 13.3% study subjects had professional qualification in A.N.M., 56.6% study subjects had professional qualification in G.N.M., 30.1% study subjects had professional qualification in B.Sc nursing. In Tiwari SK et al.[12] professional qualification was B.Sc Nursing in 59.5% nurses & general nursing and midwifery in 31.9% nurses.

In this study, 89.7% nurses attended orientation training program on BMW. In Amita et al.[11] 46.7% study subjects didn't have any BMW education. In Lavanya KM et al.[13] Out of 206 subjects, only 109(52.9%) had received training about BMW management. Majority of the nurses 67(64.4%) had undergone training.

Knowledge

In this study, most of the respondents had a great amount of knowledge regarding what is biomedical waste i.e. 98.6% gave correct responses and also 100% of the participants had a clear idea about the symbol of biomedical waste.73.1% of the participants knew why the segregation of waste is important whereas only 26.9% had a poor knowledge about this.73.8% of the participants had knowledge about the ideal bin used to dispose the waste, rest were lacking in this aspect. 80.7%, 69.7% and 63.5% knew about the right colour coded bin used for anatomical or pathological waste, glass items and official type of waste respectively. 84.1% of the respondents were correct regarding the proper disposal of sharp materials whereas only 15.9% of the respondents didn’t knew about this. Participants had average amount of knowledge in the following aspects: 64.1% were correct about the major classification of waste, 73.1% knew the importance of segregation of waste at the same time 26.9% were wrong about this, very few i.e. 53.1% had an idea regarding the responsibility to be taken if the waste gets mixed up with the yellow container, only 59.3% of the participants knew when the cover in the waste colour container has to be tied, accordingly 40.7% had no idea regarding this aspect, 72.4% were right about the time of storage of waste in the hospital. Participants had very little knowledge about how the cytotoxic was generated i.e only 48.3% gave the correct response. Knowledge regarding color coding, disposal methods, universal precautions, and biomedical waste hazard symbols are crucial for the effective management of biomedical waste.

In Gonibeedu V et al.[14] knowledge was good. In Mir MR et al.[15] knowledge regarding biomedical waste rules, color coding of waste containers, segregation of waste at source, disinfection of hospital waste before disposal & transmission of diseases through biomedical waste was very good among the nursing staff of this hospital. The values being more than 70%. In Amita et al.[11] maximum of the staff nurses 18 (60%) having very good knowledge regarding biomedical waste management, 9(30%) staff nurses having excellent knowledge, 3(10%) staff nurses having average knowledge regarding biomedical waste management. In Tiwari SK et al.[12] majority of participants had poor level of knowledge in various domains of biomedical waste management like awareness (78.5%), color coding (84.7%), biomedical waste disposal methods (92.6%), and universal precautions (97.5%) except for biomedical hazard symbol (15.3%). In Lavanya KM et al.[13] About sources of BMW, knowledge among the nurses was 81(77.9%). Knowledge about hazards to health was correct in 132 (64.1%) of the study group. It was 95(91.3%) among nurses. Hand washing as the best personal protective measure was known to 128 (62.1%) subjects with knowledge among nurses being 89(85.6%). Totally 126 (61.2%) study subjects knew about segregation at the point of generation, it was 57 (54.8%) among nurses. Totally 106(51.5%) knew about the color coded bins used for various categories of BMW. Knowledge among nurses was 61(58.7%). In Tamilselvi et al.[16] 53% were aware of the segregation of cytotoxic drugs, 90% on segregation and disposal of sharps, 72% on infectious plastics. Only 67% were aware of the different colour bags used for segregation. Proper segregation of biomedical wastes at the level of ward eliminates many of the infective diseases. This has been described previously during the Dravidian period, confirmed by the excavations near
Adichanallur. Hence, biomedical waste management practices are not new to the mankind. Some studies showed poor knowledge levels among nursing students when compared to medical students regarding biomedical waste management. Several other studies showed good/adequate knowledge levels among nurses. Another study showed adequate knowledge among nursing students regarding biomedical waste management. Nursing student needs to improve their knowledge and translate it into their clinical practice.

**Attitude**

In this study, 70.3% of the respondents strongly agreed to statement that if the health team members effectively implemented necessary measures in BMWM, the incidence of illness will be reduced and the rest states of them just agreed. 62.8% of the participants strongly agreed that the nurses and other health members should be given training on BMWM, whereas 32.4%, 2.8% and 2.1% have agreed, were undecided and disagreed respectively. 54.5% strongly agreed that there should be periodical classes and demonstration of biomedical waste management for upgrading the knowledge of the nursing staff. 46.9% strongly agreed for introducing BMWM unit into the nursing curriculum so that it will bring out effective management in the working areas in future, whereas 40% agreed, 11% were undecided and 2.1% disagreed with the statement. 33.1% of the participants both strongly agreed and agreed to the statement that it is difficult to identify and categorize the waste, 13.1% were undecided, 17.9% and 1.4% have disagreed and strongly disagreed respectively for the above statement.

In Gonibeedu V et al., attitude of the nurses towards segregation of infectious and non infectious wastes was positive with 80% in favor of implementation. In Amita et al., maximum of the staff nurses 50 (50.1%) having excellent practice level, 14 (36.6%) having very good knowledge, 1 (3.3%) having average knowledge. In Tiwari SK et al., Majority (93.3%, 91.4%, and 93.9%) of participants agreed that color-coding system is a simple method for segregating biomedical waste, wearing gloves is necessary to prevent medical waste hazards, and always putting waste in correct plastic bag respectively. About two-third (62% and 62.6%) participants agreed that biomedical waste can harm the health of the public at large, and all waste generated in hospital are infectious respectively. More than two in three participants disagreed that biomedical waste is an extra burden on their work (69.3%) and wearing PPE increases the risk of infection (68.7%). About 87.7% were willing to attend an educational program on biomedical management.

In Lavanya KM et al., the attitude of the study subjects toward BMW management as a part of their job was positive in 149(72.3%) i.e. in 86(82.7%) of the nurses. All the waste generated in the hospital is infectious was said by 134(65%) subjects with 54(51.9%) among nurses. Only 143(69.4%) said hospital policy for BMW management is needed with 90 (86.5%) among nurses. Training about BMW management is necessary according to 148(71.8%) subjects with 80(76.9%) among nurses. Positive opinion about the necessity of periodical medical examination for staff was seen in 171(83%) staff with 99 (95.2%) among nurses. In Deepika K et al., attitude of the paramedical staff who opined that the BMW management adds extra burden to their work is quite alarming. This is worrisome and such attitude must be changed and the significance of proper disposal and management of BMW should be stressed. It must not be addressed as a extra burden of work. The study also revealed that few of the health care professionals are still not aware of the disposal of the needles in puncture proof container and such ignorance will predispose to needle stick injuries. A study by Pandit NB et. al., found that 98% of the nurses had a positive attitude Mohideen, conducted a study in Karnataka in South India to assess the KAP of nurses regarding on biomedical waste management. The study revealed very negligible percentage of the nurses had high knowledge (1.7%) and more than three-quarters of the nurses had below average knowledge. The study revealed the necessity for a training program on biomedical waste management. Nursing students had an excellent attitude regarding biomedical waste management which is comparable to studies among nursing students. Studies conducted among nurses and health care workers also showed positive attitude while negative attitude was also shown among nurses. A study reported poor attitude among resident doctors regarding biomedical waste management in comparison to nursing staff.

**Practices**

In this study, majority of the participants i.e., 95.2% can identify and label infectious and non infectious waste. 98.6%, 98.6%, 97.2%, 80.7% , 86.2% and 51% of the study participants use yellow colour container with biohazard symbol for anatomical and pathological waste, red colour container with biohazard symbol for infected plastics, blue colour container with biohazard symbol for infected glass items, black colour container with biohazard symbol for cytotoxic waste, expired medicines & chemical waste, green colour container with biohazard symbol for kitchen waste and white colour container with biohazard symbol for non infected plastics and general waste respectively. 86.9% of the participants agreed that monitoring the disposal of the needles in puncture proof container is done, whereas the rest states of them just agreed. 62.8% of the participants both strongly agreed and agreed to the statement that it is difficult to identify and categorise the waste, 13.1% were undecided, 17.9% and 1.4% have disagreed and strongly disagreed respectively for the above statement.

In Gonibeedu V et al., practice was average. In Mir MR et al., attitude of the nurses towards segregation of infectious and non infectious wastes was positive with 80% in favor of implementation. In Amita et al., maximum of the staff nurses 50 (50.1%) having excellent practice level, 14 (36.6%) having very good knowledge, 1 (3.3%) having average knowledge. In Tiwari SK et al., Majority (93.3%, 91.4%, and 93.9%) of participants agreed that color-coding system is a simple method for segregating biomedical waste, wearing gloves is necessary to prevent medical waste hazards, and always putting waste in correct plastic bag respectively. About two-third (62% and 62.6%) participants agreed that biomedical waste can harm the health of the public at large, and all waste generated in hospital are infectious respectively. More than two in three participants disagreed that biomedical waste is an extra burden on their work (69.3%) and wearing PPE increases the risk of infection (68.7%). About 87.7% were willing to attend an educational program on biomedical management.

In Lavanya KM et al., the attitude of the study subjects toward BMW management as a part of their job was positive in 149(72.3%) i.e. in 86(82.7%) of the nurses. All the waste generated in the hospital is infectious was said by 134(65%) subjects with 54(51.9%) among nurses. Only 143(69.4%) said hospital policy for BMW management is needed with 90 (86.5%) among nurses. Training about BMW management is necessary according to 148(71.8%) subjects with 80(76.9%) among nurses. Positive opinion about the necessity of periodical medical examination for staff was seen in 171(83%) staff with 99 (95.2%) among nurses. In Deepika K et al., attitude of the paramedical staff who opined that the BMW management adds extra burden to their work is quite alarming. This is worrisome and such attitude must be changed and the significance of proper disposal and management of BMW should be stressed. It must not be addressed as a extra burden of work. The study also revealed that few of the health care professionals are still not aware of the disposal of the needles in puncture proof container and such ignorance will predispose to needle stick injuries. A study by Pandit NB et. al., found that 98% of the nurses had a positive attitude Mohideen, conducted a study in Karnataka in South India to assess the KAP of nurses regarding on biomedical waste management. The study revealed very negligible percentage of the nurses had high knowledge (1.7%) and more than three-quarters of the nurses had below average knowledge. The study revealed the necessity for a training program on biomedical waste management. Nursing students had an excellent attitude regarding biomedical waste management which is comparable to studies among nursing students.

Studies conducted among nurses and health care workers also showed positive attitude while negative attitude was also shown among nurses. A study reported poor attitude among resident doctors regarding biomedical waste management in comparison to nursing staff.
only 30% were reporting the injuries due to improper disposal of sharps. In Tiwari SK et al.[12] About 85.9% of participants segregate waste at their generation point. Majority of participants ensure tying up the waste bag when it is 3/4th filled (76.7%), a practice of not recapping the used needles (60.7%), dispose-off biomedical waste in the specified color-coded container (96.3%), discard used needles in needle destroyer (88.3%), record and report needlestick and sharps injury (84.0%) and change gloves between patients (81.6%). Only 66.9% and 81.6% of participants were vaccinated against Hepatitis B and TT respectively. Sadly, 60.7% had previous exposure to needle stick or sharps injury.

In Lavanya KM et al,[13] Personal protective measures while handling waste was used by 148(71.8%) subjects with 90(86.5%) nurses. Hand-washing after handling waste was practiced by 142(68.9%) subjects which was seen in 93(89.4%) nurses. In Swain C et al.[31] Staff nurses are doing only 82.5 % correct practice as per BMW New Rule. There is a scope of improvement to 100% in proper segregation practice. Because the segregation, which is the most important segment of Bio medical waste management is practically supervised by the staff nurses. Gupta et al,[32] in a study on biomedical waste management revealed the infectious and non-infectious wastes are dumped together in the hospital premises and disposed with municipal waste. The results of the study concluded the need for strict enforcement of legal provisions and a better environmental management system for disposal of bio medical waste.

In a study by Patil GV, Pokhrel K,[33] it was also found that the non-infectious waste was collected separately in different containers and treated as general waste. Singh K et. al,[34] in Chandigarh revealed that the medical establishments in the rural area and smaller ones in the urban area dispose off their biomedical waste along with municipal solid waste and no waste management system exists. Rasheed S et. Al.[35] in his study in Karachi revealed that 25% hospitals were segregating sharps, pathological waste, chemical, infectious, pharmaceutical, and pressurized containers at source. Personal protective measures while handling waste was used by 148(71.8%) subjects with significantly better use among nurses, (86.5%).[36]

Since biomedical waste management is part of the nursing curriculum, the findings of the study are staggering for nurse educators. It is a need of the hour for nursing students to be abreast with recent amendments in rules and policies regarding biomedical waste management as they will be future health care providers. Clear written guidelines and policies concerning biomedical management with regular enhancements should be made for nursing students. Regular teaching and training about recent amendments as well as newer safe and cost-effective scientific methods of waste management and periodic monitoring of practices regarding biomedical waste are highly recommended.

**CONCLUSION**

Overall, the knowledge, attitudes and practices towards biomedical waste management among the study respondents was satisfactory. Knowledge, attitudes and practices toward biomedical waste management were better among the nursing staff. Periodic assessment and regular teaching along with hands-on training programs with an emphasis on recent amendments in rules should be stressed to bridge the gap between knowledge, attitude, and practices.

**Recommendations**

- Training programs need to focus on empowering the nursing staff on biomedical waste management with broad scope and practical knowledge in all aspects. The ethical requirements and the institutional level policies form the directional pathway for the practical components in the organization.
- The right practices and other activities of BMW management and its ramifications in the form of avoiding of injuries, importance of vaccinations and following of universal precautions can be achieved when adequately supported by IEC (information, education and communication) strategies like handouts, stickers, charts, celebrations of various days like hand hygiene day and other days etc can help in bettering the practices of the employees of the organizations.
- Adequate supplies and equipment’s should be available in all the departments to take care of waste properly.
- Training the staff with checklists and regular inspections can bring about accountability in the staff.

**REFERENCES**


