ANNEXURE-I

GEETANJALI UNIVERSITY, UDAIPUR
Plagiarism Verification

1. Name of Researcher: Vijayamma Ajmera
2. Title of Thesis: To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan
3. Faculty: Nursing
4. Name of Supervisor: Dr. Jayalakshmi L.S
5. Official Designation & Address
   Dean & Director, Geetanjali College of Nursing, Udaipur, Raj.

The above thesis was scanned for similarity detection. The report is as follows:

   Software used : Small SEO Tools   Date: 08.06.2016
   Similarity Index: 91.04%   Total word count : 25801

The report is attached for the review by the Researcher/ Supervisor

__________________________
Sign. of Researcher

The plagiarism report of the above thesis has been reviewed by the undersigned

The similarity index is below accepted norms.

The similarity index is below accepted norms, because of the following reasons.

The thesis may be considered for submission to the University. The software report is attached

__________________________  ________________________
Sign. of Researcher          Sign. of Supervisor

With Seal
ANNEXURE-II

Declaration

I, Vijayamma Ajmera W/o of Sh. Krishan Kant Ajmera, 51 years, resident of Udaipur mobile no.9414164688 do hereby that take oath and state:

(i) That, I am registered for the Ph.D programme on the topic titled “To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan” in the faculty of Nursing, Geetanjali University Nursing, Udaipur. My Registration no. is GU/Ph.D/2012-13/64, dated:1.8.12.

(ii) That, the contents of my thesis submitted to the Geetanjali University, Udaipur for award of Ph.D Degree are original and my own work, and is not plagiarized.

(iii) That, if, after checking my thesis for plagiarism by any standard plagiarism checking software, are found copied or come under plagiarism, I will be solely responsible for it and university shall have sole right to cancel my research work ab-intio.

(iv) That, this work has not been submitted by me for the award of any other Degree/Diploma in any other University/Institute.

(v) That, I shall be responsible for any legal dispute/case(s) for violation of any provisions of the Copyright Act relating to my thesis.

Date: 

DEPONENT

Place: Udaipur

VERIFICATION

I, the above named deponent, do hereby take oath and verify that the contents of para (i) to (v) of above affidavit are true and correct to my personal knowledge and nothing has been concealed by me. No part of it is incorrect.

DEPONENT
GEETANJALI UNIVERSITY, UDAIPUR

Self Plagiarism Exclusion Certificate From Supervisor

The content of the chapters -1 have been published in

1. Introduction
2. Review of Literature
3. Methodology
4. Data Analysis & Interpretation
5. Discussion
6. Summary, conclusion & recommendation

This published work has been and has not been submitted for any degree to any University/Institute.

Signature of Candidate                      Signature of Supervisor
GEETANJALI UNIVERSITY, UDAIPUR

Self Plagiarism Co-Authors Certificate

We have published the following articles jointly:

<table>
<thead>
<tr>
<th>Name of Article</th>
<th>Name of Journal/Book with the details (ISSN No., etc)</th>
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<tbody>
<tr>
<td>1. A Study to Assess the Knowledge Regarding Bio-medical Waste Management among B.Sc Nursing Students of Selected Nursing Colleges of Udaipur (Raj)</td>
<td>International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064</td>
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<tr>
<td>2. Knowledge of B.Sc Nursing students on BMW management (Paper Presentation)</td>
<td>State Conference of TNAI Rajasthan State Branch Date: 2\textsuperscript{nd} Nov. 2015</td>
</tr>
</tbody>
</table>

We give our consent to Vijayamma Ajmera to make use of thesis articles for her Ph.D research.

The above research paper(s) have not been used by any of us for any of degree /Diploma in any other University.

We shall be responsible for any legal dispute /case(s) for violation of any provisions of the Copy Right Act.

**Signature of co-author**

Name: Dr. Jayalakshmi L.S.
Address: Dean & Director,
Geetanjali College of Nursing, Udaipur, Raj

**Signature of co-author**

Name: …………… Name: ……………

**Signature of Candidate**

Name: Vijayamma Ajmera
Registration no. GU/Ph.D/2012-13/64, dated: 1.8.12
CERTIFICATE OF ETHICAL CLEARANCE

GU/UEC/EC/2013/515/GD

To,
Mrs. Vijayamma Ajmera
Dept. of Nursing
Geetanjali College of Nursing
Udaipur

Date: 15-05-2013

Dear Mrs. Ajmera,

We are glad to inform you that your research proposal entitled “A study to evaluate the effectiveness of an orientation programme on knowledge and practice regarding biomedical waste management among nurses working in selected tertiary level hospitals of Udaipur district Rajasthan” has been approved by the University Ethics Committee (UEC) in its meeting held on 24th April 2013.

You are hereby directed to begin with your research project with immediate effect. The progress of the research project may be intimated to UEC at six monthly intervals.

Thanking You,

Dr. Devendra Sareen
Chairman
Geetanjali University Ethics Committee
LETTER SEEKING EXPERT OPINION AND SUGGESTIONS IN VALIDATING RESEARCH TOOL

From,

Mrs. Vijayamma Ajmera
Ph. D. Scholar,
Geetanjali College of Nursing
Udaipur (Raj.)

To,

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Subject: Request for validation of research tool.

Respected Sir/ Madam,

I Mrs. Vijayamma Ajmera, Ph.D. Scholar, Geetanjali College of Nursing have undertaken the below mentioned topic for research Project to be submitted to Geetanjali University, Udaipur as a partial fulfillment of my Ph.D. (Nursing).

Title of the topic is "Evaluate the effectiveness of orientation programme on knowledge and Practice of Biomedical waste management among Nurses Working in Selected Tertiary Level hospitals of Udaipur district, Rajasthan".

I kindly request you to provide your expert opinion & suggestions on the appropriateness of tool by using the evaluation criteria check list enclosed. Thanking you in anticipation.

Date: 
Place: 

Yours sincerely

(Mrs Vijayamma Ajmera)
Ph.D Scholar
Geetanjali College of Nursing
Udaipur (Raj.)

Enclosures:

1. Blue print of the tool
2. Tool Sec. A. Socio demographic data.
   Sec. B. Structured knowledge Questionnaire.
   Sec. C. Observation check list on Practice.
3. Criteria checklist for tool validation.
4. Content validity certificate.
CERTIFICATE OF TOOL VALIDITY

This is to certify that the tool prepared on the topic "To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan" by Ms. Vijayamma Ajmera, Ph.D. Scholar Geetanjali College of Nursing, Udaipur is found to be valid.

Place: 
Date: 
Signature of Expert

Designation and Address
# Blueprint for Knowledge Questionnaire on Biomedical Waste Management

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<tr>
<th>S. No.</th>
<th>Area</th>
<th>Knowledge</th>
<th>% of Question</th>
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<tbody>
<tr>
<td>1.</td>
<td>Concept &amp; Definition of Biomedical Waste</td>
<td>1,2,3</td>
<td>7.32</td>
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<td>2.</td>
<td>Waste Management &amp; Handling rules</td>
<td>4,5</td>
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<td>Categories of waste</td>
<td>6,7</td>
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<td>Health Hazards/ Disease transmission posed by Biomedical waste</td>
<td>8,9,10,11</td>
<td>9.76</td>
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<td>Collection of Biomedical waste</td>
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<td>Disinfection of Biomedical waste</td>
<td>14,15,16,17,18</td>
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<td>7.</td>
<td>Segregation and color coding of waste</td>
<td>19,20,21,22</td>
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<td>Storage of biomedical waste</td>
<td>23,24</td>
<td>4.88</td>
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<td>Transportation of wastes</td>
<td>25,26</td>
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<td>10.</td>
<td>Disposal/ Treatment of wastes</td>
<td>27,28,29,30,31,32,33,34,35,36,37,38</td>
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<td>11.</td>
<td>Occupational exposure and needle stick injuries</td>
<td>39,40,41</td>
<td>7.32</td>
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**Total**: 100
## BLUEPRINT FOR PRACTICE CHECKLIST

### ON BIOMEDICAL WASTE MANAGEMENT

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<td>Identification of containers for waste collection</td>
<td>1,3</td>
<td>6.06</td>
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<td>2.</td>
<td>Segregation of waste at the point of origin</td>
<td>2,4,12,17,18,21,23,30,33</td>
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<td>Use of PPE</td>
<td>6,10</td>
<td>6.06</td>
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<td>Destruction of Needle by hub cutter</td>
<td>5,9,24,28</td>
<td>12.12</td>
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<td>Practice of proper hand washing</td>
<td>20,26,31</td>
<td>9.09</td>
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<td>Proper disposal of sharps</td>
<td>11,14,15,16,22,25</td>
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<td>Labeling of waste collection containers</td>
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<td>Reporting of Needle stick injuries/Occupational exposure</td>
<td>13,32</td>
<td>6.06</td>
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<td>Maintenance of reports in BMW facility</td>
<td>7,19</td>
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100
CRITERIA CHECKLIST FOR VALIDATING THE TOOL

Respected Madam/Sir,

Kindly go through the content and place (✓) against socio demographic questionnaire in the following columns ranging from relevant to not relevant, when found to be not relevant and needs modification, kindly give your opinion in the remarks column.

SECTION-I

SOCIO DEMOGRAPHIC QUESTIONNAIRE

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SUGGESTIONS:

_________________________________________________________________
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Signature of the Expert and Designation
### SECTION-II

**STRUCTURED KNOWLEDGE QUESTIONNAIRE**

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**SUGGESTIONS:**

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**Signature of the Expert and Designation**
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**SUGGESTIONS:**
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Signature of the Expert and Designation
TOOL FOR DATA COLLECTION

TOOL FOR ASSESSING KNOWLEDGE AND PRACTICE ON BMW MANAGEMENT

Instruction to participants:

Please answer all questions. Tick correct choice (only one choice). Your identity and answers will be kept confidential. Scoring system for each question will be score of ‘1’ for correct response and ’0’ for incorrect answer.

SECTION-I
Demographic variables

Code No:
Date:
1. Age in years
   a) 20-29
   b) 30-39
   c) 40-49
   d) 50 and above
2. Sex
   a) Male
   b) Female
3. Educational Qualification
   a) Diploma
   b) Graduation
   c) Post-Graduation
4. Area of work
   a) Medical
   b) Surgical
   c) Maternity
   d) Operation theater
   e) Pediatric Department
   f) Others
5. Years of Experience
   a) Less than 1 year
   b) 1-5 years
   c) 5-10 years
   d) 10 years and above
6. Type of health care organization.
   a) Public
   b) Private
7. Area of residence.
   a) Urban
   b) Rural

SECTION- II

STRUCTURED KNOWLEDGE QUESTIONNAIRE

Concept & Definition of BMW

1. Bio medical waste is:
   a) any waste that is not intended for further use.
   b) any waste that is generated in the diagnosis treatment or immunization.
   c) Biological & non biological waste generated other than from hospital.
   d) Any waste comprising news papers, cardboards, catering waste etc.

2. Primary source of origin of Bio Medical Waste is :
   a) Industries
   b) House-holds
   c) Hospital, nursing homes, Diagnostic centers
   d) IT companies

3. Which of the following is not component of bio medical waste:
   a) Tissues organs, body parts
   b) waste generated during research in Veterinary hospitals
   c) Discarded medicines and cytotoxic drugs
   d) Waste generated from industries

Waste Management & Handling Rules

4. Primary source of origin of Bio Medical Waste is :
   a) Industries
   b) House-holds
   c) Hospital, nursing homes, Diagnostic centers
   d) IT companies

5. Bio Medical Waste should be treated within:
   a) 48 hrs.
   b) 12 hrs.
   c) 56 hrs.
   d) 32 hrs.

Categories of Waste

6. Human anatomical, micro-biological and bio-technological waste are disposed in
a) Yellow bags  
b) Blue bags  
c) Black bags  
d) Red bags  

7. Category No. 4 of biomedical waste includes:  
a) Liquid waste generated from laboratory  
b) Waste sharps including needles, syringes, scalpels etc  
c) Biotechnological wastes  
d) Discarded medicines and cytotoxic drugs  

**Health Hazards and Disease Transmission Posed by BMW**  

8. Following are the health hazards associated by poor waste management process EXCEPT.  
a) Encouraging recycling and repacking of disposables  
b) Increased risk of infections to health care workers  
c) Nosocomial infections in patients  
d) Reuse and recycle the waste to the extend possible  

9. Major risks (diseases) associated with hospital waste handling are:  
a) Aids, HEP-B, Typhoid fever, TB  
b) Malaria, Psoriasis, Diabetes mellitus  
c) Anaemia, Nephritis, Filariasis  
d) Hypertension, Sinusitis  

10. Hazards from Genotoxic waste can result from the following EXCEPT.  
a) Preparation of or treatment with particular drugs  
b) Inhalation of aerosols  
c) Absorption through the skin  
d) Ingestion of food contaminated with cytotoxic drugs  

11. The personnel at risk by biomedical waste exposure are:  
a) Doctors, Nurses & para medical staff  
b) Patients receiving treatment  
c) Community people & scavengers  
d) All of the above  

**Collection of BMW**  

12. All of the statements are true except.  
a) Containers must be cleaned on the out side surface  
b) Containers must be closed except when adding and removing waste  
c) Any type of container can be used to collect hazardous waste  
d) Contents must be compatible with the type of containers  

13. What is the scheduled frequency of waste collection from the wards?
a) Once in a day  
b) Twice in a day  
c) Thrice in a day  
d) Once in two days

Disinfection of BMW

14. Different methods of disinfection for BMW waste used are:
   a) Chemical, Autoclave, Hydroclave  
b) Burning,  
c) Boiling  
d) Fumigation

15. Mutilation/ shredding is done to
   a) Prevent unauthorized reuse  
b) Recycle the disposable items  
c) Disinfect the used items  
d) Discharge into drains

16. The sharps before putting into containers must be
   a) Disinfected with antiseptics  
b) Mutilated by a needle cutter  
c) Discard directly into dustbins  
d) Burning

17. The liquid waste generated from laboratory are disposed by.
   a) Deep burial  
b) Land filling dissolution  
c) Discharged into drains after chemical treatment  
d) Disposed into municipal waste

18. Chemical agents used for disinfection of sharps before disposal:
   a) Savlon  
b) Sodium hypochlorite  
c) Betadine solution  
d) Spirit

Segregation and Color Coding

19. What is the quantum of waste generated by a hospital
   a) 2-3 kg/bed/day  
b) 1-2 kg/bed/day  
c) 500 gm/bed/day  
d) 4-5 kg/bed/day

20. Different color bags used in Bio Medical Waste are:
   a) Green, Pink, Orange  
b) Grey, Violet, Purple
c) Orange, Yellow, Green
d) Black, Yellow, Red, Blue

21. The purpose of segregation of waste is
   a) Prevention of occupational hazards
   b) Prevent disease transmission
   c) Helpful in final disposal
   d) All of the above

22. If yes, who is responsible for segregation of waste?
   a) Nurse
   b) Doctor
   c) Auxiliary staff
   d) All of the above

23. Radioactive wastes includes:
   a) metal cans
   b) waste from offices and public areas
   c) wastes contaminated by nucleosides
   d) Waste generated from a veterinary hospitals

24. The color code for normal waste is:-
   a) Red
   b) Black
   c) Yellow
   d) Blue

Transportation of BMW

25. Is there any means of transporting bio medical waste in your facility?
   a) Yes, special means
   b) Yes, common means
   c) No means

26. If yes, is it used for
   a) One ward
   b) Different ward
   c) Don’t know

Disposal & Treatment of BMW

27. Bio Medical Waste should be treated within:
   a) 48 hrs.
   b) 12 hrs.
   c) 56 hrs.
   d) 32 hrs.
28. Safe management of Bio Medical Waste is the:
   a) Responsibility of government.
   b) Team work of health care workers.
   c) Don’t know

29. Incineration is:
   a) Process of steam sterilisation
   b) High temperature thermal process
   c) Microwave technology
   d) Method of land filling

30. Human anatomical, micro-biological and bio-technological waste are disposed in:
   a) Yellow bags
   b) Blue bags
   c) Black bags
   d) Red bags

31. Discarded medicines and cyto-toxic drugs are to be disposed into:
   a) Green bags
   b) Black bags
   c) Red bags
   d) Grey bags

32. Used needles has to be put into:
   a) Yellow bags
   b) Rigid puncture proof container
   c) Red bags
   d) Don’t know

33. Soiled dressing and used impression materials are disposed off in:
   a) Blue bags
   b) Red bags
   c) Black bags
   d) Don’t know

34. Used disposable plastic items are disposed off in:
   a) Yellow bags
   b) Red bags
   c) Black bags
   d) Don’t know

35. Human tissue are disposed off in:
   a) Yellow bags
   b) Red bags
   c) Black bags
   d) Blue bags
36. Plaster of paris is disposed off in
   a) Yellow bags
   b) Red bags
   c) Black bags
   d) Don’t know

37. Where do you put off the gloves?
   a) With medical waste
   b) With common waste
   c) Open

38. Hydroclave is a method of:
   a) Pre-vacuum type treatment
   b) Steam sterilisation process
   c) Autoclave system
   d) Sterilisation under pressure

**Occupational Exposure & NSI**

39. All of the steps should be followed after occupational exposure with infected blood/body fluids and contaminated sharps EXCEPT.
   a) Exposed parts should be washed with soap and water
   b) Pricked finger should be kept in antiseptic lotion
   c) Splashes to eyes should be irrigated
   d) Splashes to skin to be flushed with water

40. Which is the major consequence of a needle stick injury with a contaminated needle?
   a) Blood loss
   b) Disease transmission
   c) Occupational hazard
   d) None of the above

41. To whom did you report in case of needle stick injuries?
   a) Ward in-charge
   b) Infection control department
   c) ART centre
   d) Occupational health department
# SECTION- III

## OBSERVATION CHECKLIST ON PRACTICE OF BIO MEDICAL WASTE MANAGEMENT

<table>
<thead>
<tr>
<th>S.No</th>
<th>Task/Practice</th>
<th>Always</th>
<th>Sometimes</th>
<th>Never</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Containers are identified and distinguished for waste collection.</td>
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<tr>
<td>2</td>
<td>Colour coding of waste is done before disposal.</td>
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<tr>
<td>3</td>
<td>Use of prescribed coloured bags and bins to dispose different types of wastes.</td>
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<td>4</td>
<td>Clearly defined procedure for collection and handling of BMW.</td>
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<td>5</td>
<td>Destruction of needles after use by a needle cutter.</td>
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<td>6</td>
<td>Respondents are using protective wears.</td>
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<td>7</td>
<td>Maintenance of records of BMW in facility.</td>
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<td>8</td>
<td>Proper Storage facility provided for collection of wastes.</td>
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<td>9</td>
<td>Hub cutter available for needles and syringes.</td>
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<td>10</td>
<td>Use of PPE while handling Biomedical waste.</td>
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<td>11</td>
<td>Disinfection of Biomedical waste done before disposal.</td>
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<td>12</td>
<td>Practice to prevent and minimize waste production during procedures.</td>
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<td>13</td>
<td>Maintenance of records of occupational exposure through Biomedical waste.</td>
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<td>14</td>
<td>Used disposable plastic items are disposed off in blue bags.</td>
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<td>15</td>
<td>Human tissues are disposed off into yellow bags.</td>
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<td>16</td>
<td>Live attenuated vaccines are disposed off into red bags.</td>
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<td>17</td>
<td>Infectious waste is separated from non-infectious wastes.</td>
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<td>18</td>
<td>Waste specific colour bags are used with marking for collection of wastes.</td>
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<td>19</td>
<td>Instruction postures are displayed in wards.</td>
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<td>20</td>
<td>Cleaning and disinfection of containers conducted.</td>
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<td>21</td>
<td>Waste collection containers are labeled properly.</td>
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<td>22</td>
<td>Transportation facility is available for separate wards.</td>
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<td>23</td>
<td>Designated bags are used for collection of wastes.</td>
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<td>24</td>
<td>Needles are destroyed immediately after use.</td>
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<td>25</td>
<td>Bins and bags are properly covered.</td>
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<td>26</td>
<td>Proper hand washing facility is available in the unit.</td>
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<td>27</td>
<td>Containers are labeled with bio hazards symbol.</td>
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<td>28</td>
<td>Recapping or needles after use.</td>
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<td>Containers are closed except when removing or adding waste.</td>
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<td>30</td>
<td>Containers are compatible with the type of waste.</td>
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<td>31</td>
<td>Hand washing is practiced before and after procedures</td>
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<td>Needle stick injuries are reported to the concerned</td>
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<td>32</td>
<td>Segregation of waste is done at the point of origin</td>
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To,

The Professor & Head,
Bal chikitsalaya,
Udaipur

Subject: Seeking permission for conducting pilot study.

Respected Sir,

It is for your kindful information that myself working as Principal at Govt. College of Nursing, MBGH, Udaipur is pursuing my Ph.D in Nursing from Geetanjali University, Udaipur.

My research topic is “Evaluate the effectiveness of orientation programme on knowledge and Practice of Biomedical waste management among nurses working in selected hospitals of Udaipur districts, Rajasthan”.

I request you to kindly permit me to conduct study in Bal chikitsalaya, MBGH, Udaipur.

Thanking you,

Your’s faithfully

(Mrs. Vijayumma Ajmera)
Off. Principal
Govt. College of Nursing
M.B.G.H, Udaipur (Raj.)

Enclosure:
1. Ethical permission letter
2. 1 set of tool
LETTER REQUESTING PERMISSION TO CONDUCT THE MAIN STUDY

From: Vijayamma Ajmera  
Ph.D. Scholar,  
Geetanjali College of Nursing,  
Udaipur

To,  
………………………………  
…………………………  
……………………

Through,  
The Principal,  
Geetanjali College of Nursing  
Udaipur

Sub: Seeking Permission for conducting the Main study.

Respected Sir / Madam,  
My self Ph.D scholar of Geetanjali College of Nursing affiliated to Geetanjali University, Udaipur is hereby requested that I am conducting a research for the purpose of partial fulfillment of my course.

The topic selected for the study “To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan”

I request you to kindly permit me to conduct the study in your esteemed Institution. Hope you will consider my request and will do the needful.

Thanking you,

Date:  
Place: Udaipur  
Principal  
Geetanjali College of Nursing Udaipur  
(Rajasthan.)

Yours faithfully  
(Vijayamma Ajmera)
ANNEXURE-VIII (a)

PERMISSION LETTER (SETTING-I)

To,

The Principal & Controller,
RNT Medical College,
Udaipur, Raj.

Subject: Seeking permission for research study.

Respected Sir,

It is for your kindful information that myself working as Principal at Govt. College of Nursing, MBGH, Udaipur is pursuing my Ph.D in Nursing from Gectanjali University, Udaipur.

My research topic is “Evaluate the effectiveness of orientation programme on knowledge and Practice of Biomedical waste management among nurses working in selected hospitals of Udaipur district, Rajasthan”.

I request you to kindly permit me to conduct study at R.N.T. Medical College & Associated Group of Hospitals, Udaipur.

Thanking you,

Your’s faithfully

(Mrs. Vijayamma Ajmera)
Principal
Govt. College of Nursing
M.B.G.H, Udaipur (Raj.)

Enclosure:
1. Ethical permission letter
2. 1 set of tool
ANNEXURE-VIII (b)

PERMISSION LETTER (SETTING-II)

From:
Vijayamma Ajmera
Ph.D Scholar
Geetanjali College of Nursing
Udaipur, (Rajasthan)

To,
Principal,

PINS, UDAIPUR
Udaipur, (Rajasthan)

Subject: Seeking permission for conducting the research study.

Respected Sir/Madam,

Myself is a Ph.D scholar of Geetanjali College of Nursing, Udaipur. I have to conduct a research on “Evaluate the effectiveness of an Orientation programme on knowledge and practice regarding biomedical waste management among staff nurses of selected hospitals of Udaipur District, Rajasthan”.

I request you to kindly permit me to conduct the study in your esteemed institution on the above topic.

Thanking you,

Date: 18/6/2015
Place: UDAIPUR

(Allowed)
Nursing Super

Kindly cooperate and V. Ajmera for research work

(Vijayamma Ajmera)
Principal, Geetanjali College of Nursing

Your faithfully,

13/7/2015

Deen

G. L. Leher
From:
Vijayamma Ajinera
Ph.D Scholar
Geetanjali College of Nursing
Udaipur, (Rajasthan)

To,
The Medical Supdt.,
Geetanjali Medical College & Hospital
Udaipur, (Rajasthan)

Subject: Seeking permission for conducting the research study.

Respected Sir/Madam,

Myself is a Ph.D scholar of Geetanjali College of Nursing, Udaipur. I have to conduct a research on “Evaluate the effectiveness of an Orientation programme on knowledge and practice regarding biomedical waste management among staff nurses of selected hospitals of Udaipur District, Rajasthan”.

I request you to kindly permit me to conduct the study in your esteemed institution on the above topic.

Thanking you,

Date: 2/6/2015
Place: UDAIPUR

Your faithfully,

(Vijayamma Ajinera)
Ph.D Scholar
Geetanjali Col.
UDAIPUR
From,
Mrs. Vijayamma Ajmera
Ph. D. Scholar,
Geetanjali College of Nursing
Udaipur (Raj.)

To,
Principal
Pacific Medical College & Hospital
Udaipur (Raj.)

Subject: Permission for Data Collection

Respected Sir/ Madam,

I Mrs. Vijayamma Ajmera, Ph.D. Scholar, Geetanjali College of Nursing have undertaken the below mentioned topic for research Project to be submitted to Geetanjali University, Udaipur as a partial fulfillment of my Ph.D. (Nursing).

Title of the topic is "Evaluate the effectiveness of orientation programme on knowledge and Practice of Biomedical waste management among nurses working in selected hospitals of Udaipur district, Rajasthan".

I kindly request you to permit me to conduct study in your esteemed institution.

Date: 18/15
Place UDAIPUR

Yours sincerely

(Mrs. Vijayamma Ajmera)
Ph.D Scholar
Geetanjali College of Nursing
Udaipur (Raj.)

Enclosures:
1. Blue print of the tool
2. Tool Sec. A. Socio demographic data.
   Sec. B. Structured knowledge Questionnaire.
   Sec. C. Observation check list on Practice.
3. Criteria checklist for tool validation.
4. Content validity certificate.
## LIST OF EXPERTS WHO VALIDATED THE TOOL

<table>
<thead>
<tr>
<th>Dr. (Col). Jayalakshmi</th>
<th>Dr. Jayalakshmi L.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director, Symbiosis</td>
<td>Dean &amp; Director</td>
</tr>
<tr>
<td>College Of Nursing,</td>
<td>Geetanjali College Of Nursing,</td>
</tr>
<tr>
<td>Pune, Maharashtra</td>
<td>Udaipur</td>
</tr>
<tr>
<td>Dr. S. K. Verma</td>
<td>Dr. Narendra Mogra</td>
</tr>
<tr>
<td>Associate Prof.</td>
<td>Prof. &amp; Hod</td>
</tr>
<tr>
<td>Dept. Of Medicine,</td>
<td>Dept. Of Pathology</td>
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<td>Jhalawad Med. College</td>
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<tr>
<td>Dr. (Brig). Mrs. K. K. Sharma,</td>
<td>Dr. Subhash C. Sharma</td>
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<tr>
<td>Principal, SKIMHSR</td>
<td>Director, SKIMHSR</td>
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<td>Dr. Mahipal Singh Choudhary</td>
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<tr>
<td>Mr. Hemant Trivedi</td>
<td>Mr. Dalpat Singh</td>
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<tr>
<td>Statistician</td>
<td>Plant Manager,</td>
</tr>
<tr>
<td>GIGA Byte Computers, Udaipur</td>
<td>Bio Medical Plant,</td>
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<tr>
<td></td>
<td>Umarda, Udaipur</td>
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</tbody>
</table>
Dear Participant,

My self Ph.D scholar of Geetanjali College of Nursing affiliated to Geetanjali University, Udaipur is conducting the study “To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan” hope you will co-operate with me for the same. I request you to answer the given questionnaire with the most appropriate responses. The information given by you will be kept confidential and used only or the study purpose.

Kindly sign the consent form given below.

Thanking you,

Yours faithfully,

(Vijayamma Ajmera)

Consent form

I ______________here with consent for the above said study knowing that all the information provided by me will be treated with utmost confidentially by the investigator.

Date: Signature of the Participant
Place: Name and Address
ANNEXURE-XI

CERTIFICATE OF LANGUAGE EDITING

This is to certify that the dissertation entitled "To Evaluate the Effectiveness of An Orientation Programme on Knowledge and Practice Regarding Biomedical Waste Management among Nurses Working in Selected Tertiary Level Hospitals of Udaipur District, Rajasthan" developed by Ms. Vijayamma Ajmera, Ph.D Scholar, Geetanjali College of Nursing, Udaipur has been edited by me.

Date: 8 G. 2016
Place: Udaipur.

Signature

ALPHONSE C.D.
Sr. Lecturer,
St. Paul's Sr. Sec. School,
Bhopalpura, Udaipur
ORIENTATION MODULE

ON

BIOMEDICAL WASTE MANAGEMENT

Prepared By:
Vijayamma Ajmera
Ph.D Scholar
Geetanjali College of Nursing, Udaipur

Guided By:
Dr.Jayalakshmi L.S,
Dean
Geetanjali College of Nursing,
Udaipur

Supported By:
Dr.Samuel George,
Research Head
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I extend a humble word of thanks to Mr. Kishan Mali, IT expert for setting and printing this module with great interest and care.

For queries or suggestions regarding this module please contact.

Vijayamma Ajmera
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R.N.T. Medical College, Udaipur (Rajasthan)
This module has been prepared to enhance the knowledge and practice of nurses regarding Biomedical Waste Management.

Biomedical waste management is a raising emerging issue in India especially in Rajasthan. Researches concludes that periodical trainings and orientation programmes can help to improve the knowledge and practice of nursing personnel regarding biomedical waste management.

To comply with the biomedical waste [management and handling] rules and to safeguard their own health, nursing staff should have knowledge and perform their duties that should ensure safe handling, collection, Storage, treatment and disposal of biomedical waste.

By this module the nurses working in clinical setup can enhance their knowledge about BMW management and the consequences of improper management. I hope that this module will definitely help them for effective improvement in their knowledge and practice regarding bio medical waste management in health care facilities.
OBJECTIVES

General Objective:

After going through this orientation module you will be able to,

- Enhance knowledge and practice regarding bio medical waste management in your health care facility.

Specific Objectives

1. Introduction
2. Statistics
3. Concept and definition of Bio medical waste.
4. Sources of bio medical waste
5. Classification of Biomedical wastes
6. Personal at risk and occupational hazards related to Bio medical waste management
7. Categories of Bio medical waste
8. Types of containers and colour coding system
9. Steps of Bio medical waste management process
10. Instructions and safety measures to waste handlers
11. Nurses roles and responsibilities in Biomedical waste management
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</tbody>
</table>
Introduction:

Every system in nature progresses towards disintegration and it contribute to creating waste. This waste is a great threat to ecological balance by polluting the environment. A modern hospital is a complex multidisciplinary approach system which consumes thousands of items for delivery of medical care. All these products consumed in hospital leave some unusable leftovers which is called biomedical waste.

From total quantity of waste generated by health care activities almost 80-90% is non infectious which comes from house keeping functions of hospital and laboratories. The balance 10-20% waste is considered hazardous and/or infectious. The waste generation rate ranges from 0.5 kg -2 kg/bed/day.

With a judicious planning and management the risk due to these wastes can considerably reduced. Effective management of BMW is legal necessity as well as a social responsibility.

Concept and definition of biomedical waste

According to Biomedical waste (Management & Handling) Rules 1998. Biomedical waste refers to any waste which is generated during the diagnosis, treatment or immunization of humans or animals or in research activities.

Statistics:

Approx. 3 million heath care workers experience percutaneous exposure to blood born viruses each year which results in an estimated 16000 hepatitis C, 66000 hepatitis B and 200-5000 HIV infection annually in India.

Around 700 injuries per 1000 nursing staff per week were found out of which 60% were needle pricks due to lack of awareness.

Study conducted in Bombay (2009) revealed that in India one person dies in every 20 seconds due to use of contaminated needles.

Every year 16000 million injections are administered world wide, but not all of the needles and syringes are properly disposed. WHO estimated that in 2000 injections with contaminated syringes caused 21 million Hepatitis B, 2 million Hep C, and 260000 HIV infections worldwide. It is estimated that annually about 0.33 million tones of hospital waste is generated in India.
Classification of biomedical waste:

![Biomedical Waste Diagram]

- **Non Hazardous (75-90%)**
- **Hazardous (10-25%)**
  - **Infectious (15-18%)**
    - Non sharps
    - Sharps
    - Plastic disposables
    - Liquid wastes
  - **Other Hazardous (5-7%)**
    - Radioactive waste
    - Discarded glass
    - Pressurised container
    - Chemical Waste
    - Cytotoxic Waste
    - Incinerator ash

(a) **Infectious waste:** This category includes.
- Cultures and stocks of infectious agents from laboratory work.
- Waste from surgery and autopsies on patients with infections diseases.
- Waste from infectious patients in isolation ward.
- Waste that has been in contact with infected patients undergoing hemodialysis.
- Infected animals from laboratories.

(b) **Pathological waste:** consists of tissues, organs, body parts, human fetuses and animal carcasses, blood and body fluids.
(e) **Sharp** : are items that could cause cuts or puncture wounds including hypodermic needles, scalpel and other blades, knives, infusion sets, saws, broken glass.

(d) **Pharmaceutical Wastes** : includes expired unused split and contaminated pharmaceutical products, drugs, vaccines and sera that are no longer required.

(e) **Genotoxic Wastes** : is highly hazardous and have mutagenic teratogenic or carcinogenic properties. Genotoxic wastes may include certain cytostatic drugs, vomit, urine or faeces from patients treated with cytostatic drugs, chemicals and radio active materials.

(f) **Chemical Waste** : consists of discarded solid, liquid and gaseous chemicals from diagnostic and experimental works. Eg Formaldehyde, photographic chemicals.

(g) **Waste with high content of heavy metals** : are highly toxic. Wastes generated by spillage from broken clinical equipments like thermometer, blood pressure gauges etc.

(h) **Pressurised Containers** : Many types of gas are used in health cares and are often stored in pressurised cylinders, cartridges and aerosol cans.

(i) **Radioactive wastes** : The ionizing radiations of interest in medicines include Xray, alpha and beta particles, gamma rays emitted by radio active substances.
Categories of Bio Medical Wastes

<table>
<thead>
<tr>
<th>WASTE CATEGORY</th>
<th>TYPE OF WASTE</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category No. 1</td>
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<td>Incineration/ Deep Burial</td>
</tr>
<tr>
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<td>Animal Waste</td>
<td>Incineration/ Deep Burial</td>
</tr>
<tr>
<td>Category No. 3</td>
<td>Microbiology &amp; Biotechnology Waste</td>
<td>Local Autoclaving/ Microwaving/Incineration</td>
</tr>
<tr>
<td>Category No. 4</td>
<td>Waste Sharps</td>
<td>Autoclaving/Microwaving/Disinfection/Chemical Treatment</td>
</tr>
<tr>
<td>Category No. 5</td>
<td>Discarded Medicine &amp; Cytotoxic drugs</td>
<td>Incineration &amp; Drug disposal in safe landfills</td>
</tr>
<tr>
<td>Category No. 6</td>
<td>Soiled Waste</td>
<td>Incineration/Autoclaving/ Microwaving</td>
</tr>
<tr>
<td>Category No. 7</td>
<td>Solid Waste</td>
<td>Autoclaving/Microwaving/ Disinfection</td>
</tr>
<tr>
<td>Category No. 8</td>
<td>Liquid Waste</td>
<td>Chemical treatment &amp; discharge into drains</td>
</tr>
<tr>
<td>Category No. 9</td>
<td>Incineration Ash</td>
<td>Landfill</td>
</tr>
<tr>
<td>Category No. 10</td>
<td>Chemical Waste</td>
<td>Chemical treatment &amp;</td>
</tr>
</tbody>
</table>

Sources of health care waste

The sources of health care waste can be classified as major or minor according to the quantities produced.
(a) The major sources of biomedical waste

- Hospitals and other health care establishment
- Out patient clinic
- Dialysis center
- Laboratory and research centers
- Mortuary and autopsy centers
- Animal research and testing
- Blood banks and blood collection services
- Nursing homes for disabled persons
- Biotechnology centres

Health Impacts and occupational hazards:
The main groups of health care workers at risk are the following -

- Doctors, nurses, health care auxiliaries and hospital maintenance personnel.
- Patients in health care establishments or receiving home care.
- Visitors to health care establishments
- Workers in health care services allied to health care establishments laundries, waste handling and transport.
- Workers in waste disposal facilities, including scavengers.

Occupational Hazards can result from
Percutaneous Injury
- Radiation burns
- Mucocutaneous Injury
- Contact with non intact skin
The diseases transmitted are HBV 30%, HCV 18%, HIV 0.3%, Tuberculosis, typhoid fever and all other types nosocomial infections.

Waste minimization:
Waste minimization can be encouraged by the implementation of certain policies. Such as:
- Source reduction:
- Recyclable products
- Good management and control practices:
- Waste segregation:
- Safe use and recycling:
Collection:

All containers should be located at the point of generation of waste. Bags are filled only 3/4\(^{\text{th}}\) capacity, tied securely and recovered from site of generation regularly and timely.

Collection:

- Waste should be collected daily and transported to the designated central storage site.
- No bag should be removed unless they are labelled with their point of production and content.
- The bags or containers should be replaced immediately with new ones of the same type.
Segregation:

The most appropriate way of identifying the categories of health care waste is by sorting the waste into colour coded plastic bags or containers. The responsibility of keeping waste separated apart according to the composition and characteristics is the prime responsibility of the nursing staff.

All waste bags or containers should be labeled with basic information on their content and on the waste producer. This information may be written directly on the bag or container or on pre-printed labels, securely attached.
Storage:
The categories of waste which may need decontamination/disinfection should be removed only after treatment. No untreated waste should be stored beyond 48 hrs.

The waste in bags or containers should be stored in a separate room or building size appropriate to the quantities of waste produced and the frequency of collection.

Transportation

During transportation the waste routes should be designated and time should be ear marked. Biomedical waste should be transported only in vehicles authorised by Govt.

Disposal:
- Always remember to disinfect mutilate the waste before its disposal.
- Syringes to be cut with hub cutter and disinfect with it bleaching solution.
- Infected plastics should be chemically disinfected or auto claved.
- The location of deep burial site will be distance from residential areas i.e down with population less than five lakhs and rural areas. It should be ensured that no contamination with ground water and not be prone to flooding or erosion.
- Final disposal is done by incineration, deep burial, auto-claving, land filling, shredding etc.

Type of Containers and Recommended Colour Coding System
### Categories of waste and treatment options:

<table>
<thead>
<tr>
<th>Waste category</th>
<th>Colour coding</th>
<th>Type of container</th>
<th>Treatment option as per schedule I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category 1,2,3 &amp; 6</td>
<td>Yellow</td>
<td>Plastic Bag</td>
<td>Incinerating Deep Burial</td>
</tr>
<tr>
<td>Category 3,6 &amp; 7</td>
<td>Red</td>
<td>Disinfected container / Plastic Bag</td>
<td>Autoclaving Micro waving, Chemical treatment</td>
</tr>
<tr>
<td>Category 4 &amp; 7</td>
<td>Blue / White</td>
<td>Plastic Bag/ Puncture proof container</td>
<td>Autoclaving / Micro waving Chemical treatment &amp; destruction / shredding</td>
</tr>
<tr>
<td>Category 5, 9 &amp; 10 (Solid)</td>
<td>Black</td>
<td>Plastic Bag</td>
<td>Disposal in secured land fill</td>
</tr>
</tbody>
</table>

### Instructions to staff who handle clinical waste bags & containers:

Staff who handle clinical waste bags and containers should be trained to be aware of the following to avoid injuries and accidents.

- When waste bags containers are three fourth full, they should be sealed.
- All bags and containers must confirm colour coding system. Labeling can be done by writing the information.
- Separation of biomedical wastes to be done at source.
- Check that waste bags are effectively sealed.
- Origin of the waste is marked on the waste bag or container.
• Bag should be picked up by the neck and placed.

• Manual handing of waste bags should be minimized to reduce the incidence of needle stick injuries.

• Bags should not be clasped against the body and too many bags should not be carried at a time.

• Staff should know the appropriate cleaning and disinfection procedures.

• Secure plastic colour coded bags before waste handling.

• Staff should wear personnel protective equipments (PPE) while handling waste.

• All accidents while doing therapeutic, diagnostic and handling of waste should be recorded.

All health care workers should be made aware of BMW rule 1998 through training programmes.
Nurses role and responsibility:

- Disinfect the waste so that it is no longer the source of pathogenic organisms.
- Reduce the bulk in order to reduce requirements for storage and transportation.
- Make waste unrecognizable for aesthetic reason.
- Make recyclable items unusable. E.g. cutting up syringes and damaging the needles.
- Disposable items like gloves, syringes, etc. should be mutilated after use.
- Waste minimization can be done by Purchase of reusable items made of glass, rubber, metal etc.
- Strengthen sterilization procedure
- Colour coding of bags to be done as per rules.
- Needles, syringes, sharps should be placed in a puncture resistant plastic metal containers at the work station. Do not recap the used syringes
- For disinfection use 1% hypochlorite or equivalent disinfectant ensuring all surface come in contact with chemicals contact time at least 30 mts.
- Changing chemical solutions frequently at least once a day.
- Always handling with gloves and masks, apron and boots to be used if splashing is expected.
- Use sharp decontaminating unit made up of outer, solid plastic puncture proof and inner perforated container with handles and filled 1/3 with hypochloride.
BIO-MEDICAL WASTE MANAGEMENT

Presented by:
Vijayamma Ajmera
Ph.D. Scholar
Principal, Govt. CON
Udaipur, Raj.
INTRODUCTION

- Medical care – vital in our life and health.
- BMW – emerged as issue of concern world over.
- BMW real problem for Human and Environment
- Safe scientific cost effective methods BMW management – need of hour.

WASTES

- Solid waste
- Liquid Waste
- Gaseous Waste

- Household waste
- Industrial waste
- Biomedical waste or hospital waste

What is Bio-medical waste

Definition
Waste generated during the diagnosis, testing, treatment, research or production of biological products for humans or animals (WHO)

Healthcare Waste Characterization:
- Healthcare Waste
- Non Risk Waste (75-90)%
- High Potential for ARR
- Risk Waste (10-25)%

• WHO estimates
  - 85% of hospital waste is non-hazardous
  - 10% is infectious
  - 5% is non-infectious.
WHO has estimated that

In year 2000

- injections with contaminated syringes caused:
  - 21 million hepatitis B virus (HBV) infections (32% of all new infections);
  - Two million hepatitis C virus (HCV) infections (40% of all new infections);
  - 260,000 HIV infections (5% of all new)

Biomedical waste Statistics

Developed Countries- 1.5 kg/bed/day, with variations among countries.

In India-

- 1.2 kg/bed/day with variation among Govt. and Private establishments.
- Approximately 502,74 tons/day waste generated
- Out of which only 57% waste undergoes proper disposal

Sources of Bio-Medical Waste

Major Sources
- Hospitals
- Labs
- Research centers
- Animal research
- Blood banks
- Nursing homes
- Mortuaries
- Autopsy centers

Minor sources
- Clinics
- Dental clinics
- Home care
- Cosmetic clinics
- Paramedics
- Funeral services
- Institutions

WHO IS AT RISK??

Patients & attenders
Sanitation workers
Medical & Paramedical staff
Public
Hazardous health care waste can result in:

1. Infection
2. Genotoxicity and Cytotoxicity
3. Chemical toxicity
4. Radioactivity hazards.
5. Physical injuries

Infection

The infectious agents enter into the body through:

- Puncture
- Abrasion
- Cut in the skin
- Through mucous membranes
- By inhalation and ingestion.

Most Common Infections

1. Gastro enteric through faeces and/or vomit
   - e.g. *Salmonella*, *Vibrio Cholerae*, *Helminthes*, *Hepatitis A*
2. Respiratory through inhaled secretions
   - e.g. *Mycobacterium tuberculosis*, *Measles virus*, *Streptococcus pneumoniae*
3. Ocular infections through eye secretions
   - e.g. *Herpes virus*,
4. Skin infection through pus
   - e.g. *Streptococcus spp.*, 
5. Meningitis through Cerebrospinal fluid
   - e.g. *Neisseria meningitides*

Most Common Infection Cont.

6. Blood borne diseases
   - AIDS
   - Septicaemia and bacteremia
   - Viral Hepatitis B & C

7. Hemorrhagic fevers through body fluids
   - Lassa, Ebola and Marburg viruses
PROBLEM ASSOCIATED WITH BMW

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>DISEASES CAUSED</th>
<th>RELATED WASTE ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIRUSES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HPV, Hepatitis B, Hepatitis A, Adenoviruses, Enteroviruses</td>
<td>AIDS, Infectious Hepatitis, Infectious Hepatitis, Dengue, Japanese encephalitis, tick-borne fever, etc.</td>
<td>Infected needles, body fluids, Human excreta, soiled linen, blood, body fluids.</td>
</tr>
<tr>
<td>BACTERIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonella typhi, Vibrio cholerae, Clostridium Tetani, Pseudomonas, Streptococcus</td>
<td>Typhoid, Cholera, Tetanus Wound infections, septicaemia, rheumatic fever, endocarditis, skin and soft tissue infections</td>
<td>Human excreta and body fluid in landfills and hospital wards, Sharp such as needles, surgical blades in hospital waste.</td>
</tr>
<tr>
<td>PARASITES</td>
<td>Cutaneous Leishmaniasis, Kala Azar, Malaria</td>
<td>Human excreta, blood and body fluids in poorly managed sewage system of hospitals.</td>
</tr>
</tbody>
</table>

Genotoxicity and Cytotoxicity

- Irritant to skin and eyes
  - E.g. alkylating agent, intercalating agent
- Carcinogenic and Mutagenic
  - E.g. Secondary neoplasia due to chemotherapy

Chemical Toxicity

- Many drugs are hazardous
- May cause intoxication, burns, poisoning on exposure

Radioactivity Hazards

Radioactive waste exposure may cause headache, dizziness, vomiting, genotoxicity and tissue damage

Physical Injuries

- Sharps
- Chemicals
- Explosive agents

Waste with high content of heavy metals

Broken Mercury Thermometers

Blood pressure gauges
LEGISLATION

- Recognizing the deadliest nature of the Bio-Medical Waste, the Government and Pollution Control Boards under the guidelines of Ministry of Environment and Forests (MOEF).
- MOEF have promptly designed and issued guidelines to the hospitals to ensure a proper and safe disposal of bio-medical waste.
- "BIO-MEDICAL WASTE Management & Handling RULE 1998 came into effect.
- Provides uniform guidelines and code of practice for Bio-medical waste management.

Biomedical Waste Management and Handling Rules, 1998 [Amended in 2000]

- These rules apply to all persons who generate, collect, receive, store, transport, treat, dispose or handle bio-medical waste in any form. All Institutions generating BMW must take all steps to ensure that such waste is handled without any adverse effect to human health and the environment.

PENALTIES AS PER RULES

- The PENALTIES are as specified in Environment (Protection) Act 1986.
- Imprisonment for up to five years with fine up to one lakh rupees, or both.
- In case the failure additional fine up to five thousand rupees for every day.

Bio-Medical Waste Disposal Cycle

[Diagram of the cycle with labels: Legislation (BMW Rule), Implementing Authority, Waste Generator (Hospitals), Common Facility (Transportation, Treatment And Disposal), and Waste to Reuse, Disposal (Recycling & Landfills).]

Bio-Medical Waste Flow Chart

[Diagram showing the flow of waste with labels: Generator (Hospitals), In-Hospital Segregation (Collection, Segregation, Packing, Disposal Under Five Rules), Common Storage Points At Hospitals, Transportation (Specialized Services), Unloading and Temporary Storage at CBWITF, Treatment (Disinfection, Autoclaving and shredding), Disposal (Recycling & Landfills).]
### Categories of Biomedical Waste Schedule as per WHO Standard

<table>
<thead>
<tr>
<th>WASTE CATEGORY</th>
<th>TYPE OF WASTE</th>
<th>TREATMENT AND DISPOSAL OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category No. 1</td>
<td>Human Anatomical Waste (Human tissues, organs, body parts)</td>
<td>Incineration@ / Deep burial*</td>
</tr>
<tr>
<td>Category No. 2</td>
<td>Animal Waste (Animal tissues, organs, body parts, carcasses, bedding products, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals and colleges, discharge from hospitals, animal houses)</td>
<td>Incineration@ / Deep burial*</td>
</tr>
<tr>
<td>Category No. 3</td>
<td>Microbiology &amp; Biotechnology Waste (Wastes from laboratory cultures, stocks or specimens of live micro-organisms or attenuated viruses, human and animal cell cultures used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, losses and services used for transfer of cultures)</td>
<td>Local autodigestion/microwave / incineration@</td>
</tr>
</tbody>
</table>

### Categories of Biomedical Waste Schedule as per WHO standards cont....

<table>
<thead>
<tr>
<th>WASTE CATEGORY</th>
<th>TYPE OF WASTE</th>
<th>TREATMENT AND DISPOSAL OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category No. 8</td>
<td>Liquid Waste (Waste generated from the laboratory and washing, cleaning, housekeeping and disinfecting activities)</td>
<td>Disinfecting by chemical treatment@ and discharge into drains</td>
</tr>
<tr>
<td>Category No. 9</td>
<td>Incineration- Ash (Ash from incineration of any biomedical waste)</td>
<td>Disposal in municipal landfill</td>
</tr>
<tr>
<td>Category No. 10</td>
<td>Chemical Waste (Chemicals used in production of biologicals, chemicals used in disinfecting, as pesticides, etc.)</td>
<td>Chemical treatment@ and discharge into drains for liquids and secured landfill for solids.</td>
</tr>
</tbody>
</table>

### COLOR CODING FOR SEGREGATION OF BMW 1998

<table>
<thead>
<tr>
<th>COLOR</th>
<th>WASTE</th>
<th>TREAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Human &amp; Animal anatomical waste / Microbiology waste and regulated cotton/ dressings/ linens/ bedding etc.</td>
<td>Incineration/DB/</td>
</tr>
<tr>
<td>Red</td>
<td>Tubings, Catheters, IV sets</td>
<td>Autodigestion/microwave/chemical treatment</td>
</tr>
<tr>
<td>Blue/White</td>
<td>Waste sharps (Needles, Syringes, Scalpels, blades etc.)</td>
<td>Autodigestion/microwave/chemical treatment/destruction/shredding</td>
</tr>
<tr>
<td>Black</td>
<td>Discarded medicines/cytotoxic drugs, Incineration ash, Chemical waste.</td>
<td>Disposal in landfills</td>
</tr>
</tbody>
</table>

### COLOUR CODING AND TYPE OF CONTAINER FOR DISPOSAL OF BIO-MEDICAL WASTES 2011

<table>
<thead>
<tr>
<th>Colour coding</th>
<th>Type of container to be used</th>
<th>Waste Number</th>
<th>Category</th>
<th>Treatment options as per schedule I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Non-chlorinated plastic bags</td>
<td>Category 1, 2, 3, 6</td>
<td>Incineration</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>Non-chlorinated plastic bag (sharp proof container for sharps)</td>
<td>Category 1, 2, 3, 4</td>
<td>As per Schedule 1 (rule 7)</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>Non-chlorinated plastic bag container</td>
<td>Category 2, 3, 4</td>
<td>As per Schedule 1 (rule 7)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>Non-chlorinated plastic bags</td>
<td>Municipal Waste</td>
<td>Disposal in Municipal dump areas</td>
<td></td>
</tr>
</tbody>
</table>

### HOW TO MANAGE BMW??

1. Survey of waste generated.
2. Reduction at source.
5. Storage of waste.
6. Transportation of waste.
7. Treatment of waste.
Source Reduction

- **Source Reduction** - ways to lessen the amount of material
  - **Segregation** - keeping noninfectious waste out of the infectious waste stream
  - **Minimization** - reduce or eliminate waste at the source
  - **Engineering controls** - methods to reduce quantity of waste (smaller containers)

Steps to Manage Hazardous Wastes before Disposal

1. Know what hazards you have.
2. Purchase smallest quantity needed, and don’t purchase hazardous materials if safe alternative exists

**Use mercury-free thermometers**

Steps to Manage Hazardous Wastes

3. Limit use and access to trained persons with personal protective gear

6. Label of Hazard Warnings

- Inflammable
- Toxic
- Gas bottle
- Explosive
- Radiation
- Biohazard
- Corrosive
- Health danger

Segregation of waste

- At the point of generation
- In a color coded leak-proof container
- Container should bear ‘Biohazard’ symbol and appropriate wording
- Container should never be completely filled
Segregation of waste should be observed strictly

- To avoid mixing of general (non-infectious) waste into infectious waste. Once mixed, becomes infectious and should not be removed.
- To reduce infectious waste
- To decrease expenditure on disposal of infectious waste

**COLOR CODING FOR SEGREGATION OF BMW 1998**

<table>
<thead>
<tr>
<th>COLOR</th>
<th>WASTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Human &amp; Animal anatomical waste / Micro-biology waste and soiled cotton/dressings/linen/beddings etc.</td>
</tr>
<tr>
<td>Red</td>
<td>Tubes, Catheters, IV sets.</td>
</tr>
<tr>
<td>Blue/Water</td>
<td>Waste sharps ( Needles, Syringes, Scalps, Blades etc.)</td>
</tr>
<tr>
<td>Black</td>
<td>Discarded medicines/cytotoxic drugs, Inoculation ash, Chemical waste.</td>
</tr>
</tbody>
</table>

**SEgregation of Solid Bio-Medical Waste**

**Pretreatment before disposal: Cont.**

- Waste
  - Tubes used for serum separation, centrifugation of samples, preparation of dilutions etc.
  - Sample cups, Tips, Caps.
  - Any other contaminated plastic wares

Method: Chemical Disinfection
- Sodium hypochlorite
- Final Disposal: Blue bag

**Waste disposed without pretreatment**

- Yellow bag
  - Contaminated gloves; latex & plastic (Uncontaminated — general waste)
  - Contaminated tissue & blotting papers
  - Contaminated cotton
  - Human tissue/organ

- White sharp disposal container
  - Broken glass, pipettes, broken test tubes,
  - Needles, razor blade, scalpel

**PACKAGING & LABELING:**

- Bags 3/4th filled should be tied,
- Be supervised Name of Ward,
- Date of Packaging,
- Destination (Treatment Site)
- Bio Hazard/Cytotoxic Symbol
- Weighing & Recording
- Separate Register and Weighing Machine
- Daily recording is mandatory
Collection, transportation, storage (within the hospital)
- Waste collected and stored in thick non-corrosive disposable plastic bags or containers of specific colour code.
- The waste in bags or containers should be stored in a separate area, room, or building of a size appropriate to the quantities of waste produced and the frequency of collection.
- Health care waste should be transported within the hospital or other facility by means of hand cart wheeled trolley.

LABEL FOR TRANSPORT OF BIO-MEDICAL WASTE CONTAINERS/BAGS
- Date of generation
- Waste category No
- Waste class
- Waste description
- Sender's Name & Address
- Contact Person
- Receiver's Name & Address
- Contact Person
- In case of emergency please contact, Name & address
Label shall be non-washable and prominently visible.

TRANSPORTATION
- Transportation of BMW can be divided into internal and external transportation.
- INTERNAL: it is for yellow, red, blue and white bags.
- EXTERNAL: it is for the general waste collected in the black coloured plastic bags.

Do you have a bio-spill kit?
- Container of undiluted household bleach
- Several pairs of gloves
- Safety glasses
- Absorbent material
- Biohazardous waste (autoclave) bags
- Dust pan & scoop or tongs for broken glass
Place in a labeled bag or bucket and keep in areas where biohazards are used.

DISPOSAL METHODS OF BIO-MEDICAL WASTES
- Incineration
- Chemical disinfection
- Inertisation
- Autoclave
- Encapsulation
- Microwave
- Shredder
- Plasma pyrolysis
- Deep burial
- G.J. Multicidave Ltd is external agency managing final disposal in this zone.

BMW RULES 2011 v/s 1998

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every occupier generating BMW, irrespective of the quantum of waste comes under the BMW Rules and requires to obtain authorization</td>
<td>Occupiers with more than 700 beds required to obtain authorization</td>
<td></td>
</tr>
<tr>
<td>Duties of the operator listed</td>
<td>Operator duties absent</td>
<td>Biomedical waste divided into ten categories</td>
</tr>
<tr>
<td>Categories of Biomedical Waste reduced to Eight</td>
<td>Biomedical waste divided into ten categories</td>
<td>Rules restricted to HECs with more than 1000 beds</td>
</tr>
<tr>
<td>Treatment and disposal of BMW made mandatory for all the HECs</td>
<td>A format for annual report appended with the Rules</td>
<td>No format for Annual Report</td>
</tr>
</tbody>
</table>
ACCIDENT REPORTING

• 1. Date and time of accident:
• 2. Sequence of events leading to accident
• 3. The waste involved in accident:
• 4. Assessment of the effects of the accidents on human health and the environment:
• 5. Emergency measures taken
• 6. Steps taken to alleviate the effects of accidents
• 7. Steps taken to prevent the recurrence of such an accident

STAFF SAFETY

• Proper training
• Personal protective clothing and equipment
• Immunization
• Post-exposure prophylaxis
• Medical surveillance
• Personal hygiene

Responsibility

Infection control is everyone’s responsibility. You are not only protecting yourself, but also those around you.

Conclusion

✓ Thus refuse disposal cannot be solved without public education.
✓ Individual participation is required.
✓ Municipality and government should pay importance to disposal of waste economically.
✓ Thus educating and motivating oneself first is important and then preach others about it.
✓ PPE does not replace proper procedures and techniques, consider all as hazard.
Our’s is a Beautiful Planet...Let us save together...

Lets Make This World A Better Place to Live in.
ANNEXURE-XIII

(Paper-I)
A Study to Assess the Knowledge Regarding Bio-Medical Waste Management among B.Sc Nursing Students of Selected Nursing Colleges of Udaipur (Raj)

Vijayamma Ajmera¹, Dr. Jayalkshmi L. S.²

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²Dean, Geetanjali College of Nursing, Udaipur (Raj.), India

Running Title: Knowledge on Biomedical Waste Management among Nursing Students

Abstract: Medical care is vital for our life, health and well being. But the waste generated from medical activities can be hazardous, toxic and even lethal because of their high potential of disease transmission. Illegal and unscientific reuse can be extremely dangerous and even fatal. The present study was undertaken to assess the knowledge regarding biomedical waste management among B.Sc. nursing students at Udaipur, Rajasthan. 120 samples were selected using probability sampling. The findings revealed that high level of knowledge among respondents was 61.67%, moderate level of knowledge among 33.33% and low level of knowledge was 5% among respondents regarding biomedical management. The study concluded that low level of knowledge was found in the areas such as source of origin of biomedical management such as source of origin, disposal of waste, disease transmission, etc. Following the study, the investigator provided an information booklet which will help the BSC nursing students to enhance their knowledge. The study also revealed that there is no significant association between knowledge scores and demographic variables.

Keywords: Biomedical waste, Knowledge, Practice

1. Introduction

Hospitals and other health care institutions are one of the essential commodities of daily life. They generate “wastes” day in and day out which may be the potential health hazards to health workers. While hospitals claim to dispose off their wastes as per the stipulated norms, it is shocking to note that much of the infectious waste including needles, syringes, catheters, etc. are being recycled only to find its way back into the market. Waste requiring special attention includes those that are potentially infectious, sharp e.g. needle, scalps, other subjects capable of puncturing the skin, plastic waste establishments, pharmaceutical waste and a variety of chemically hazardous waste used in laboratories.

Keeping in view inappropriate biomedical waste management, the Ministry of Environment and Forests notified the “Biomedical Waste (management and handling) Rules, 1998” in July 1998. In accordance with these Rules (Rule 4), it is the duty of every “occupier” i.e. a person who has the control over the institution and or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment and the waste is treated within 48 hours period.

2. Need for Study

Health care institutions are one of the essential commodities of daily life. They generate “wastes” day in and day out which may be the potential health hazards to health workers. The adequate management of wastes assumes tremendous importance in a country like India, whose economy forces the poverty stricken and ignorant ragpickers to sift and sort through dumped waste materials in order to earn subsistence.

While hospitals claim to dispose off their wastes as per the stipulated norms, it is shocking to note that much of the infectious waste including needles, syringes, catheters, etc. are being recycled only to find its way back into the market. Although health care wastes comprise a very small portion of the entire waste stream, it deserves special attention because of the hazards it can pose to human health. Waste requiring special attention includes those that are potentially infectious, sharp e.g. needle, scalps, other subjects capable of puncturing the skin, plastic waste establishments, pharmaceutical waste and a variety of chemically hazardous waste used in laboratories. Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste in any health set up for which the health care workers...
are to be trained. Personnel responsible for the disposal of BMW were not adequately trained which lead to inappropriate management and insufficient implementation of regulations. Employees indiscriminately used coloured bags without any organised segregation or treatment. The present scenario of BMW management in Indian hospitals is grim and it should be mandatory for health care establishments to ensure that such waste is handled without any adverse effects to human health.

Handling, segregation, sterilization, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste in any health set up for which the health care workers are to be trained.

Studies conducted concluded that regular training and awareness about waste management activities among nursing personnel needs to be held to increase knowledge regarding hospital waste management.

Statement of problem
A study to assess the knowledge regarding bio-medical waste management among B.Sc nursing students of selected nursing colleges of Udaipur (Raj) with a view to develop an information booklet.

Objectives of the study
1) To assess the knowledge regarding bio-medical waste management among B.Sc nursing students.
2) To find out the association between knowledge scores and selected demographic variables regarding biomedical waste management.
3) To prepare and distribute an information booklet on biomedical waste management among B.Sc nursing students.

3. Methodology
Research approach and design: To assess the knowledge regarding biomedical waste management among B.Sc nursing students a descriptive design with cross sectional survey approach was used.

Setting of the study
The study was undertaken in Sanawati College of Nursing, Udaipur College of Nursing & Sanjeewani College Of Nursing, Udaipur.

Population:
The population for the study comprised B.Sc Nursing students of part 2,3 and 4 of selected nursing colleges.

Samples
Samples of the study were B.Sc nursing students of the selected colleges of Udaipur.

Sample size
Sample size were 120. The samples included 40,35 and 45 students respectively from each college.

Sampling technique
In the present study the B.Sc Nursing students were selected by simple random sampling (Lottery method).

Inclusion criteria
The following inclusion criteria are set to select the samples.
- B.Sc Nursing students
- Students available at the time of data collection
- Studying in II, III and IV year.
- Those who have consented to participate in the study.

Exclusion criteria
Samples excluded in the present study were students,
- Not available at the time of data collection.
- Those who were not consented to participate in study.

Description of the Tool
A structured knowledge questionnaire was prepared and used to assess knowledge regarding BMW Management based on the objectives containing 22 questions.

Section A: Consisted of items on demographic data age, Sex, class, area of residence, awareness and source of information.
Section B: Consisted of structured knowledge questionnaire on Biomedical waste management based on the following aspects.
- source of origin of biomedical waste
- waste management and handling rules
- disease transmission
- colour coding
- segregation of waste
- disposal of waste

The tool used was tested for validity and reliability and a pilot study was conducted to establish the feasibility and administering the tool.

Validity of the Tool
Items were judged by experts for relevance, clarity and appropriateness. Modifications were done in the tool as per expert opinion.

Reliability of the Tool:
Reliability was established by split Half method.

The steps adopted for development of information booklet were as follows:-
- Review of Literature
- Journals, Books, internet as sources used
- Opinions and suggestions from guide

The contents covered the following areas:-
- Definition of Biomedical waste
- Sources of BMW
- Categories of BMW
- Colour coding system
- Treatment options of wastes
- Instruction to staff who handle clinical wastes.
- Nurses role and responsibilities in BMW management.
Data Collection Procedure
Written permission was obtained from Principals of Saranwati College of Nursing, Udaipur College of Nursing, Sanjeevani College of Nursing, Udaipur prior to data collection. The sample included 40, 35 and 45 students respectively from each college. The purpose of the study was explained to participants and assured the confidentiality of their response. The information booklet was administered to the participants.

Plan for data analysis
Data were analyzed as follows:
- Described demographic characteristics.
- Mean, SD, and mean % were used to describe area wise knowledge scores.
- ANOVA and Z test used to find out association of knowledge with demographic variables.

4. Results
The demographic characteristics of the respondents revealed that- 
Similar percentage of respondents 40.83% each belongs to the age group 26-21 and 21 and above, 12.50% of respondents to age group of 19-20 and only 5.83% belongs to 18-19 years of age. Majority 71.6% of respondents were male and 28.33% were female.

The findings show that the percentage of male candidates (71.67) migrating in B.Sc nursing course is more than female(28.33) candidates.

Majority 53.33% of respondents belongs to III yr. B.Sc nursing, 30.83% in II yr and 15.83% in IV yr. B.Sc nursing.

Majority 94.17% of respondents were aware about BMW management and only 5.83% of respondents were not aware of BMW management.

Majority 65.33% of respondents got information from teachers, 23.33% from health team members, 15% from mass media, 0.83% from friends.

Equal percentage, 50% of respondents belong to rural and urban background

Area wise percentage of knowledge scores

<table>
<thead>
<tr>
<th>Area of Knowledge</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of Origin</td>
<td>57.5</td>
<td>19.68</td>
</tr>
<tr>
<td>Waste Management and Handling Rules</td>
<td>51.67</td>
<td>23.33</td>
</tr>
<tr>
<td>Disease Transmission</td>
<td>63.22</td>
<td>19.68</td>
</tr>
<tr>
<td>Color Coding</td>
<td>54.58</td>
<td>23.33</td>
</tr>
<tr>
<td>Segregation of Waste</td>
<td>54.58</td>
<td>23.33</td>
</tr>
<tr>
<td>Disposal of Waste</td>
<td>54.58</td>
<td>23.33</td>
</tr>
<tr>
<td>Treatment of BMW</td>
<td>54.58</td>
<td>23.33</td>
</tr>
</tbody>
</table>

Area wise knowledge scores revealed that knowledge of respondents regarding color coding was 91.11%, waste management and handling rules 84.17%, segregation of waste 63.22%, source of origin 57.5%, treatment of BMW 54.58% and the lowest percentage of knowledge found for disposal of waste 45.83% which is the most sensitive aspect of BMW management. Hence it was necessary for the investigator to improve the knowledge by providing with information booklet.

The findings of the study was similar to study conducted by Chandra Bose and Jagdish (2013) which revealed that nurses used color bags indiscriminately and disposal of BMW were not adequately done which lead to inappropriate management.

The findings revealed that the B.Sc nursing students had inadequate knowledge in the areas like methods of disposal of Bio medical waste, disease transmission and source of origin of BMW, so it is concluded that level of knowledge of...
B.Sc nursing students can be enhanced by education and training programs.

Level of Knowledge regarding BMW management

The findings show that high level of knowledge among respondents was 61.67%, moderate level of knowledge among 33.33% and low level of knowledge was 5% among respondents regarding BMW management.

Level of knowledge regarding BMW management

The findings of the study were similar with study conducted by Chandra Boser and Jagdish which revealed that nurses used color bags indiscriminately and disposal of BMW were not adequately done which led to inappropriate management.

Association between knowledge scores and selected demographic variables

Association between knowledge scores and selected demographic variables such as age in years (r=0.61), gender (r=-0.67), class (r=0.788) area of residence (r=0.678), awareness regarding BMW management (r=1.43), source of information (r=0.62).

This indicates that there is no significant association between demographic variables and knowledge scores regarding biomedical waste management.

5. Recommendations

Based on the findings of the study the following recommendations are suggested:

- A similar study can be conducted for large population of preservice and in-service nurses.
- Comparative study can be conducted for diploma & degree nursing students.
- Correlational study can be conducted on knowledge attitude & practice among nursing students on this topic.
- Experimental study can be conducted on knowledge attitude and practices of B.Sc nursing students of Bio medical waste management.

References

Certificate of Publication

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Authored
By
Vijayamna Ajmera

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RAJASTHAN STATE BRANCH
TNAI - SNA CONFERENCE, JAIPUR
2nd November 2015
Theme: Clean and Healthy India: Nurses' Concern

Compiled by: Jogendra Sharma
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Vijayamma Ajmera,
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Govt. College of Nursing, Udaipur
TRAINED NURSES' ASSOCIATION OF INDIA

SNA CONFERENCE
2" November 2015 held at Jaipur
Organized by TNAI Rajasthan State Branch
Theme: "Clean and Healthy India: Nurses' Concern"

CERTIFICATE

This certificate is awarded to Dr. / Mr. / Ms. [signature]
for being an Organizer / a Resource Person / Presenter of a Paper / Participant in Poster
Exhibition / Delegate in the Conference entitled to "Clean and Healthy India: Nurses' Concern".

Suneeta Mishra
President
TNAI Rajasthan State Branch

JOGENDRA SHARMA
Organizing Chair Person
Vice President TNAI Rajasthan State Branch
Photograph 1- The scholar conducting orientation programme
Photograph 2- Improper placement of bins and poor segregation

Photograph 3- Improper storage of biomedical waste
STATISTICAL FORMULAS USED FOR ANALYSIS OF DATA

1. Mean = $\frac{\Sigma x}{N}$

2. Standard Deviation

$$SD = \sqrt{\frac{\Sigma x^2 - \left( \frac{\Sigma y^2}{N} \right)}{N - 1}}$$

3. Reliability co-efficient

$$r = \frac{\Sigma (x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma (x - \bar{x})^2(y - \bar{y})^2}}$$

4. Spearman- Brown Prophecy Formula

$$r^1 = \frac{2r}{1 + r}$$

Where:

$r$= the correlation coefficient on the split halves

$r^1$= the estimated reliability of the entire test
5. Paired ‘t’ test

\[ t = \frac{\text{mean}(d)}{\text{SE}(d)} \]

Where \( d = x - y; \) \( x = \) pretest scores

\( y = \) posttest scores

\[ \text{SE}(d) = \frac{\text{SD}(d)}{\sqrt{n}} \]

Where

- \( \text{SD}(d) = \) standard deviation of \( d \)
- \( n = \) no. of paired observation

where \( \text{SD} = \) standard deviation

6. ‘Z’ test

\[ Z = \frac{\text{Mean}(X) - \text{Population} (\mu)}{\text{SE of Sample Mean}} \]

7. Chi-square test

\[ X^2 = \frac{(O - E)^2}{E} \]

Where: \( O = \) Observed frequency

\( E = \) Expected frequency

8. Degree of freedom

\( df = (r-1)(c-1) \)

Where \( df = \) Degree of freedom

- \( r = \) number of rows
- \( c = \) number of columns