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Research Article

"A Study On The Adherence To Biomedical Waste Management In Katihar Medical College"

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Abstract
Introduction: Generation of Biomedical Waste (BMW) in healthcare facilities is an unavoidable factor for the clinical practices and care of patients. The frequent use of disposable materials in the hospital enhances the amount of generation of BMW. It is necessary to manage BMW compliance with BMWM Rules 2016 to avoid any type of public health hazards and environmental pollution.
Material and method: This study consists of observation by using checklist for the availability of colour coded bins in six different departments for BMWM for 40 days. The questionnaire was used to know about the socio-demographic characteristics, knowledge and attitude of participants towards the segregation of BMW according to BMWM Rules,2016.
Results: The infection control protocols were least followed for **white bins** regarding all the observational parameters except bins with closed fitting cover by the staff in KMC. The awareness level of the participants towards the segregation of BMW in the **OBG Department is very high, whereas the overall awareness level is low**.
Conclusion: The study reveals that the availability of colour coded bins in the departments where research was done is not followed properly. The overall knowledge and attitude about segregation of BMW among the participants was low. The study suggests the recommendation of conducting periodic in-service training among the existing staff and for the new staff at the time of induction. The proper training record should be maintained so that all the staff would train effectively and efficiently time to time.

Keywords: Biomedical Waste, Biomedical Waste Management, Infection Control, Hospital Acquired Infections, Biomedical Waste Segregation, Colour Coded Bins.

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INTRODUCTION:

According to WHO, Biomedical Waste (BMW) means any waste, which is generated during diagnosis, treatment, or immunization of human beings or animals, or in research activities pertaining thereto, or in the production or testing of biologicals [1], in which 85% of waste generated is non- hazardous and 15% is hazardous (including 10% infectious waste and 5% non- infectious waste) [2–6].

The main purpose of BMWM is to emphasis on the inspection of HAIs and build the basic understandings of epidemiology to explain factors that cause risk for HAIs [7]. In the new era, epidemiology in healthcare is distinguished by the demand of consumer for more lucid and accountability, growing inspection and regulation, and expectations for quick decreases in the rate of HAIs. The function of BMWM is to protect and diminish the risk of HAIs. This can be accomplished by applying IC protocols in the forms of biomedical waste management (BMWM), surveillance, employee health, education, environmental hygiene, isolation, and infections prevention policies and management [8].

In this study, we discuss about BMWM compliance with Biomedical Waste Management (BMWM) Rules 2016. Generation of BMW in healthcare facilities is an unavoidable factor for the clinical practices and care of patients. The frequent use of disposable materials in the hospital enhances the amount of generation of BMW. It is necessary to manage BMW compliance with BMWM Rules 2016 to avoid any type of public health hazards and environmental pollution [9]. The BMWM Rules 2016, which is regulated by State Pollution Control Board (SPCB) in the state or Pollution Control Committee (PCC) in Union Territory, is followed by the healthcare facilities for the segregation of BMW. Generally, there are five colour coded bins i.e., red, yellow, white, black and blue, present at different places in the healthcare facility to prevent infection and proper segregation of BMW.

BMW contains pathogens and potentially harmful microorganisms which transmit infection to patients, general public, and healthcare workers (HCWs) [10]. The segregation of BMW is necessary at the point where it is generated by the person who generated BMW, so that BMW is treated and disposed of easily by using different treatment and disposed techniques like incineration of waste, autoclaving, microwaving etc.

The management of BMW in the healthcare facilities is failed due to inadequacy of awareness about infections related to BMW, absence of training for the handling of BMW, ignorance of BMW management and disposal system, inadequate financial and HRs for the management of BMW, and the less priority given to the topic like BMWM [11].

REVIEW OF LITERATURE:

In the tertiary care center, among HCWs the attitude, knowledge and practices regarding BMWM finds that the need of training regarding BMWM cannot be overemphasized. The impacts on practices of appropriate waste segregation and disposal due to deficiency of proper and thorough knowledge about BMWM was identified [12]. For handling BMW, a safe and reliable method is essential. By doing proper segregation of waste where it is generated can minimize the generation of waste. The study finds the reduction in the generation of BMW in Coimbatore Medical College, Coimbatore same as a study by WHO in India because of adequate segregation of BMW [9]. To implement the BMWM Rules in a tertiary care teaching hospital, the periodic training and focused on the implementation of the policies related to the segregation of BMW for all HCWs is crucial to optimize the compliance to proper segregation, daily surveillance, stern observation and inspections are recommended [13]. The first and prime step in the BMWM is the segregation of BMW. The BMW requires proper monitoring at all times for effective tracking. The BMW segregation & disposal index can be used for IC practice as an indicator. For minimizing inappropriate handling and segregation of BMW, there is a need to train all BMW handlers on methods and new techniques for effective waste management practices using WHO manual and PPE [14].

In a government medical college and hospital, by the waste generators the need of segregation practice should be practiced more strictly in the process of BMWM. The own incinerator plant is present in the institute but the separate route is not present for the transportation of waste for day-to-day collection. For the safety practices in handling waste, the gloves were used by only 30% sweepers whereas apron, eye-shields, long boots were worn by none. The workers who were immunized for Hepatitis- B were only three (5%) and the sweepers who were experienced for BMWM practices and were cognizant of involving risk in handling waste were only 14% [10]. The research point outs the vital points to be corrected for the BMWM. In the Puducherry Government General Hospital, the study aided in initiating a database, information and statistics on the BMWM. The result of the study applicable in the majority of cities in India, wherever the regulations for BMW are not strictly applied. The requirement of periodic training for distinct stages of hospital staff in BMWM is indicated [11].

The study has unearthed the fact that in a tertiary care hospital, among the pre-final year medical students, 50% of the students haven't had sufficient knowledge of BMWM. The duty of the medical students is to know about the safe handling and ensure the waste is disposed of properly after segregation. At regular interval, hands-on training with latest information would boost the knowledge, attitude and skills of the students so that they go a long way towards promoting a hazardous-free environment and promoting a positive healthy lifestyle [1]. For advancing the BMWM knowledge and practices of healthcare professionals, with a special focus on the nursing staff, the ongoing training programs and periodic sensitization is necessary for ensuring the effective implementation of BMWM procedures in the hospitals [15].

For waste collection, for all the colour coded bins the bags were not available. In all seven units, bins were not colour coded & properly segregated for BMWM. The collected waste from hospital was burned in open space which may affect the health of HCWs and people living in surrounding areas [16].

SCOPE:

The scope of this study is to know about BMWM compliance with BMWM Rules 2016 among the HCWs related to work practice control that includes practical techniques which help to reduce infection exposure by changing the way a task is performed.

AIM:
The aim of this study is to know about the awareness level among the participants compliance with proper segregation which is done at the point of generation of BMW by the person who generates BMW like nursing staff, doctors, OT technicians etc., assuring the proper colour coded bins present at different places in the hospital.

OBJECTIVES:
The work builds on the information that the awareness level among the HCWs about the proper BMWM based on the knowledge and attitude of the HCWs is inappropriate. Hence this study intends to find out the knowledge and attitude of the HCWs towards the IC protocols compliance in KMC. The following key parameters are formulated as guidelines to fulfill the objectives of this research. These are-

I. To observe the availability of proper colour coded bins in KMC for BMWM.
II. To know about the knowledge, attitude and practices among the participants for the segregation of BMW in KMC.

METHODOLOGY:
STUDY DESIGN:
The purpose of the study is to identify the knowledge and attitude of participants about the segregation of BMW in six different departments in KMC. The study used the observational and exploratory quantitative study design and mixed analytic approach. The study included observation of colour coded bins in six departments like Emergency Department, General Medicine Ward, Surgery Ward, OBG Department, Main OT, ICU, and questionnaire methods. The questionnaire was used to gather statistical information from participants i.e. nursing staff and OT technicians who were chosen as a sample for the study from a large population from the six departments which were selected for the research. The checklist was used to observe the availability of colour coded bins in six departments for the proper segregation of BMW.

STUDY SETTING:
The study was conducted from March 2024 to May 2024 in Katihar Medical College. It is a constituent unit of Al-Karim University, Katihar. It was established in 1987. The campus is situated in a land of fifty-five (55) acres. Presently, it has 11 different specialized departments and has attached 800 bedded hospitals with different services. The two buildings i.e. Main Building and OPD Building with three departments in each building on different floors were chosen for the research purpose. The six departments where the study was done are Emergency Department, Intensive Care Unit (ICU), General Medicine Ward, Surgery Ward, Main Operation Theater (OT), and Obstetrics & Gynaecology (OBG) Department.

RESEARCH PROCEDURE:
The observation of colour coded bins considering different parameters was done for 40 days, from the date 19th March 2024 to 13th May 2024, in six departments like Emergency Department, ICU, Main OT, General Medicine Ward, Surgery Ward, OBG Department in KMC excluding the holidays and Sundays [14,17,18]. The questionnaire was used to know about the knowledge and attitude of participants towards the segregation of BMW according to BMWM Rules 2016 [1,11–13,15,18,19] in the same six departments where the observation was done for 40 days.

SAMPLE SIZE:
The total 121 participants were included in the study for filling questionnaire. The one hundred and eleven (111) nursing staff and ten (10) OT technicians from six departments were included in the research, in which 20 nursing staff from ICU, 20 nursing staff from Emergency Department, 20 nursing staff from Surgery Ward, 20 nursing staff from OBG Department, 28 nursing staff from General Medicine Ward, and 3 nursing staff and 10 OT technicians from Main OT were participated.

SAMPLING METHOD:
Convenience sampling method was used to select 121 participants including one hundred and eleven (111) nursing staff and ten (10) OT technicians who were doing segregation and handling BMW and patient care within the KMC from six departments in the research.

Inclusion criteria: For sampling, the participants who were agreed to fill the questionnaire were chosen.
Exclusion criteria: For sampling, the participants who were not agreed to fill the questionnaire were excluded from the research.

RESEARCH INSTRUMENTS:
The observation checklist, questionnaire consisting of questions based on Multiple Choice Questions (MCQ), google forms on email, MS- Word and MS- Excel were used for collecting and analyzing primary data.

STATISTICAL DATA:
Column chart, pie chart, and tabular method were used to analyze and represent statistical data.

ETHICAL CONSIDERATION:
Informed consent was obtained, and the participants were conveyed about the basic purpose of the study and the role they would play in the study. The data of the participants is kept confidential. The permission from the departmental in-charges was taken to involve them in the study. The Medical Superintendent (MS) of Katihar Medical College (KMC) was approached for permission to do the research in KMC premises. Ethical Clearance for the study was obtained from the Institutional Ethics Committee vide their Letter No. IEC / IRB / KMC / IEC / SIT / 002 / 2024 (Information Technology). The security of data will be of great concern so that data will not use for other purposes in the future.

DATA COLLECTION:

The data was collected by using questionnaire in the printed form having total ten (10) questions related to segregation of BMW as per the BMWM Rules 2016 to know about the awareness level among the 111 nursing-staff and 10 OT Technicians of six departments.

The observation by using observation checklist including various parameters like bins are located at right place, bins are present in standing position, bins with closed fitting cover, and waste collected daily, was done for collecting data related to colour coded bins i.e. red, yellow, white, blue, and black for forty (40) days in KMC. The observation was excluded on holidays and Sundays, and all the working days were included for the observation on the daily basis.

The questionnaire included socio-demographic characteristics and questions related to segregation of BMW which were Multiple Choice Questions (MCQ) including questions based on segregation of BWM related to colour coding, BMWM Rules 2016, waste collection bags and containers, importance of segregation of BMW in the healthcare facility etc.

DATA ANALYSIS:

The overall observational study for the presence of colour coded bins in the six different departments in KMC

The following departments were included in the study-

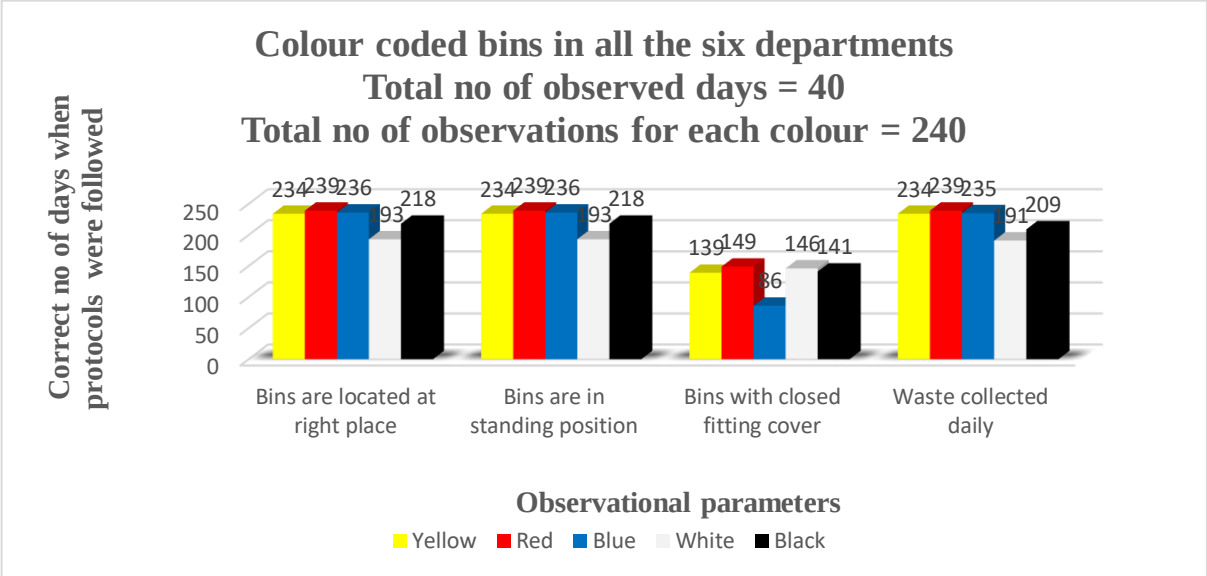
I. Emergency Department (Room no- 56),
II. Intensive Care Unit (ICU),
III. Obstetrics & Gynaecology Ward (Unit- 1 & Unit- 2),
IV. Surgery Ward (Unit-4),
V. General Medicine Ward (Unit- 1 & Unit-2), and
VI. Main Operation Theater (OT) – Surgery OT Room-2

The total number of bins in one place is 5,
The total number of observed places per day is 6,
The total number of days observed is 40,
So, the total number of observations in 40 days= 5 *6*40
= 1200
The total number of observations for each colour in 40 days= 1200/5
= 240

The table and graph containing observational parameters and the number of correct days when IC protocols were followed by staff in all six departments as a whole regarding colour coded bins are shown below:

Observational parameters	**Colour coded bins**				
	Yellow	**Red**	**Blue**	**White**	**Black**
Bins are located at right place	234	239	236	193	218
Bins are in standing position	234	239	236	193	218
Bins with closed fitting cover	139	149	86	146	141
Waste collected daily	234	239	235	191	209

Table- 1: Observational data of colour coded bins for all six departments



Graph- 1: Observational data of colour coded bins for all six departments

In the graph, in total 240 observations of each colour i.e. yellow, red, blue, white and black; the bins were presented at right place is shown as follows: 239>236>234>218>193, in percentage 99.58% > 98.33% > 97.50% > 90.83% > 80.41% that means **in total 240 observations, white bins were least present i.e. only 193 (80.41%) and red bins were highest present i.e. 239 (99.58%)**.

The bins were in standing position is shown as follows: 239>236>234>218>193, in percentage 99.58% > 98.33% > 97.50% > 90.83% > 80.41% that means **in total 240 observations, white bins were least presented in the standing position i.e. only 193 (80.41%) and red bins were highest presented in the standing position i.e. 239 (99.58%).**

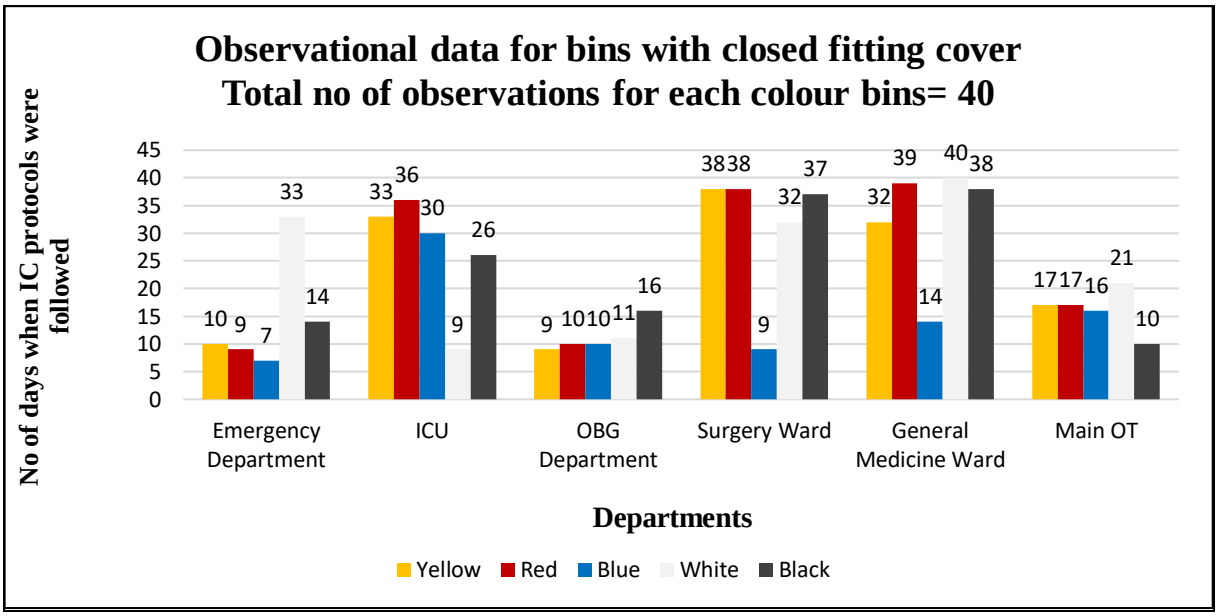
The bins with closed fitting cover are shown as follows: 149>146>141>139>86, in percentage 62.08% > 60.83% > 58.75% > 57.91% > 35.83%, **that means in total 240 observations, blue bins were least presented with closed fitting cover i.e. only 86 (35.83%) and red bins were highest presented with the closed fitting cover i.e. 149 (62.08%).**

The collection of waste on daily basis was observed is shown as follows: 239>235>234>209>191, in percentage 99.58% > 97.91% > 97.50% > 87.08% > 79.58%, that means **in total 240 observations, white bins were least collected daily in 240 Observations i.e. 191 (79.58%) and red bins were highest collected daily in 240 observations i.e. 239 (99.58%).**

Department wise observational data of colour coded bins for bins with closed fitting cover is shown below:

Departments	Colour coded bins				
	Yellow	Red	Blue	White	Black
Emergency Department	10	9	7	33	14
ICU	33	36	30	9	26
OBG Department	9	10	10	11	16
Surgery Ward	38	38	9	32	37
General Medicine Ward	32	39	14	40	38
Main OT	17	17	16	21	10

Table 2: Observational data of colour coded bins for bins with closed fitting cover department wise



Graph 2: Observational data of colour coded bins for bins with closed fitting cover department wise

The graph shows that, in the Emergency Department in KMC, **bins were not closed properly except white bins which were closed for 33 days in the total 40 days, and blue bins were least with closed fitting cover.** In the observation, it was found that **the blue colour bins were used for both blue and black colour bins, only polythene of all the colour were used to indicate the identity of the particular bin**. The black colour bin was overflowed by the waste for a few days that means the protocol of filling waste containers upto three quarters then the bins were replaced or sealed tightly, and also bins are closed properly to prevent infection, according to BMWM Rules, 2016 was not followed properly by the staff.

In the ICU, the blue colour bin was used in the place of black bin of large size. **The white bin was not closed properly i.e. only closed for 9 days in the total 40 days.**

In the OBG Department, it was found that **bins were not closed properly with closed fitting cover.** The blue colour bin was used for black colour bin, with black colour plastic polythene bag.

In the Surgery Ward, it was found that **blue bin was least closed with closed fitting cover i.e. only for 9 days in total 40 days of observations.** The green colour bin was used in the place of black colour bin, with black colour plastic polythene bag.

In the General Medicine Ward (Unit- I & II), it was found that **blue bin was least closed with fitting cover i.e. only for 14 days in all the total 40 days of observations.** The blue colour bin was used in the place of black colour bin, with the black colour plastic polythene bag.

In the Surgery OT Room-2, it was found that inside the OT Room the bins were presented in open condition except white bin because bins were directly used at the time of performing surgery and outside the OT Room bins were presented in close condition because bins were used to store the BMW that was generated inside the OT room.

Awareness level of the participants (nursing staff and OT technicians) towards the knowledge and attitude for segregation of BMW according to BMWM Rules, 2016

The knowledge and attitude of the participants towards the segregation of BMW according to BMWM Rules, 2016 is measured on the basis of following consideration-

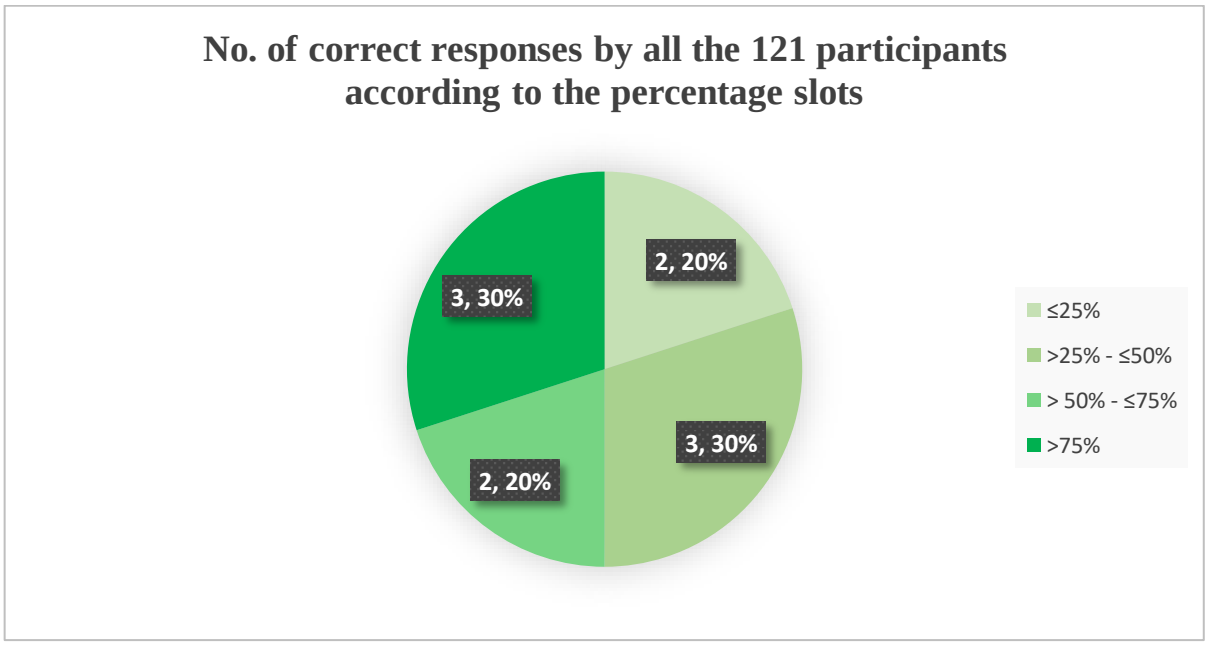
If the responses are correct for more than 50% (>50%) is 50% than the awareness level of the participants is low, 60% than the awareness level of the participants is high and 70% than the awareness level of the participants is very high.

FOR ALL SIX DEPARTMENTS:

In all six departments, the total participants were 121 in which 4 participants have age below 20 years, 86 participants come under the age group 20-30 years, 21 participants come under the age group 31-40 years, and 10 participants have age above 40 years. Whereas, in the total 121 participants, work experience of 15 participants is below one year, 46 participants have work experience within 1-3 years, 23 participants have work experience within 4-6 years and 37 participants have work experience more than 6 years.

MCQ	No. of correct responses by total no. of participants
≤25%	2 (20%)
>25% - ≤50%	3 (30%)
> 50% - ≤75%	2 (20%)
>75%	3 (30%)

Table- 3: Correct responses for awareness level of the participants in all six departments.



Graph-3: Correct responses for awareness level of the participants in all six departments.

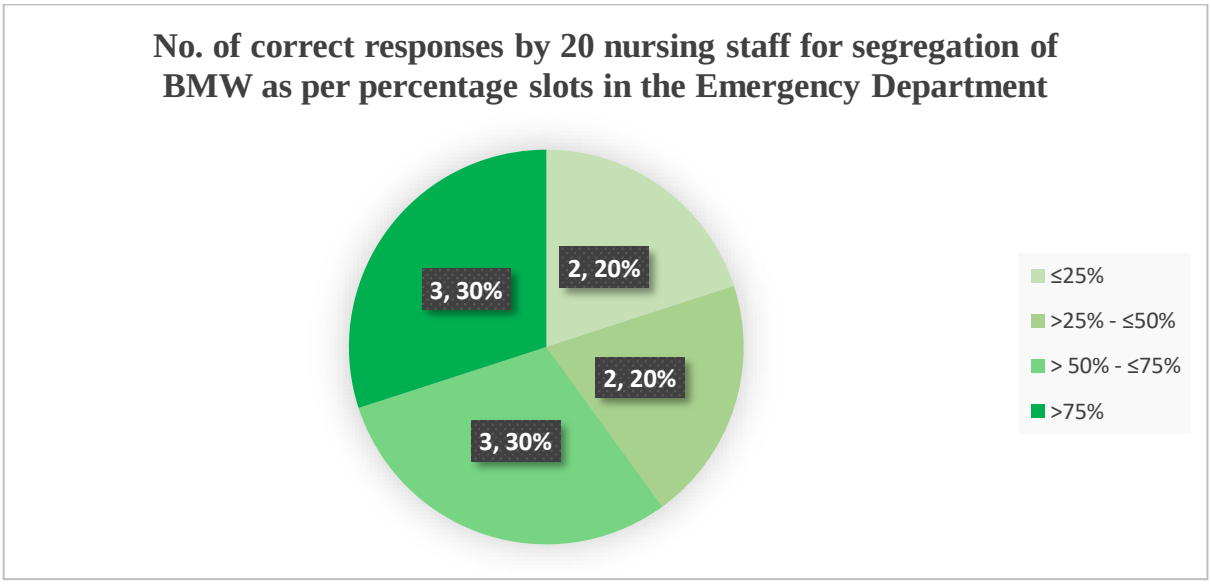
According to the graph, 20% responses were correct by all the participants for ≤ 25%; 30% responses were correct by all the participants between >25% and ≤50%; 20% responses were correct by all the participants between >50% and ≤75%; and 30% responses were correct by all the participants for >75%, **that means 30% responses are correct for >75% and 50% responses are correct for >50%, so the overall awareness level of the all participants regarding segregation of BMW according to BMWM Rules, 2016 is low.**

1. EMERGENCY DEPARTMENT:

In the Emergency Department, the total participants were 20 in which 2 participants have age below 20 years, 14 participants come under the age group 20-30 years and 4 participants come under the age group 31-40 years. Whereas, in the total 20 participants, work experience of 3 participants is below one year, 11 participants have work experience within 1-3 years, 3 participants have work experience within 4-6 years and 3 participants have work experience more than 6 years.

MCQ	No. of correct responses by total no of participants
≤25%	2 (20%)
>25% - ≤50%	2 (20%)
> 50% - ≤75%	3 (30%)
>75%	3 (30%)

Table-4: Correct responses for awareness level of the participants in the Emergency Department.



Graph-4: Correct responses for awareness level of the participants in the Emergency Department.

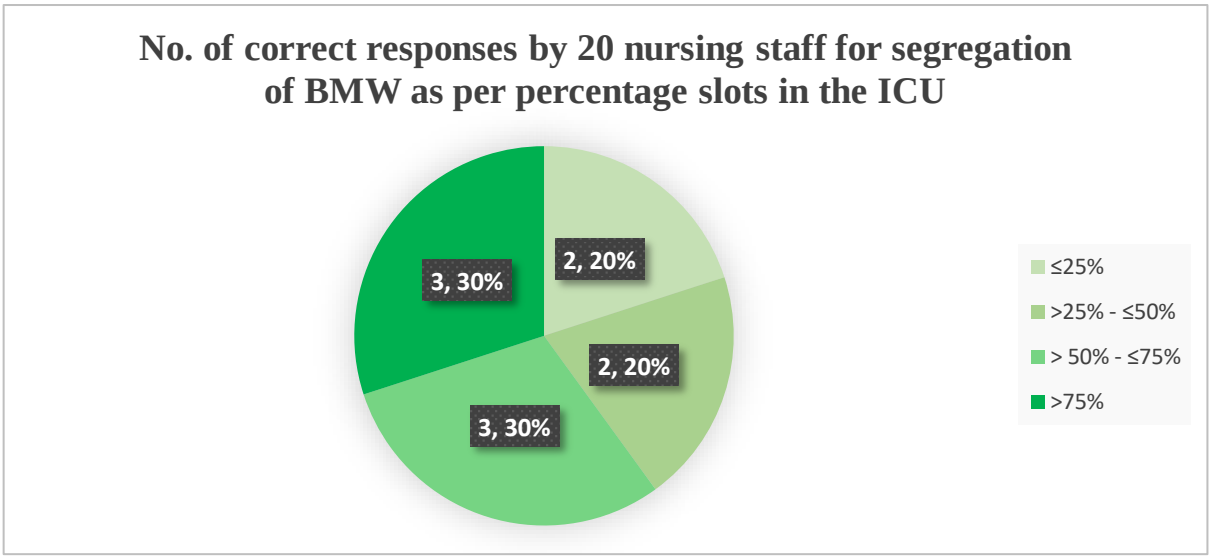
The graph shows that between more than 50% and less than & equal to 75%, the correct responses are 3 and for more than 75%, the correct responses are also 3, that **means 30% responses are correct for >75% and 60% responses are correct for >50%, which indicates that the level of awareness of nursing staff is high,** towards the segregation of BMW according to BMWM Rules 2016 in the Emergency Department in KMC.

2. INTENSIVE CARE UNIT (ICU):

In the ICU, the total participants were 20 in which the age of 19 participants come under the age group 20-30 years and 1 participant come under the age group 31-40 years. Whereas, in the total 20 participants, work experience of 7 participants is below one year, 13 participants have work experience within 1-3 years.

MCQ	No. of correct responses by total no of participants
≤25%	2 (20%)
>25% - ≤50%	2 (20%)
> 50% - ≤75%	3 (30%)
>75%	3 (30%)

Table-5: Correct responses for awareness level of the participants in the ICU.



Graph-5: Correct responses for awareness level of the participants in the ICU.

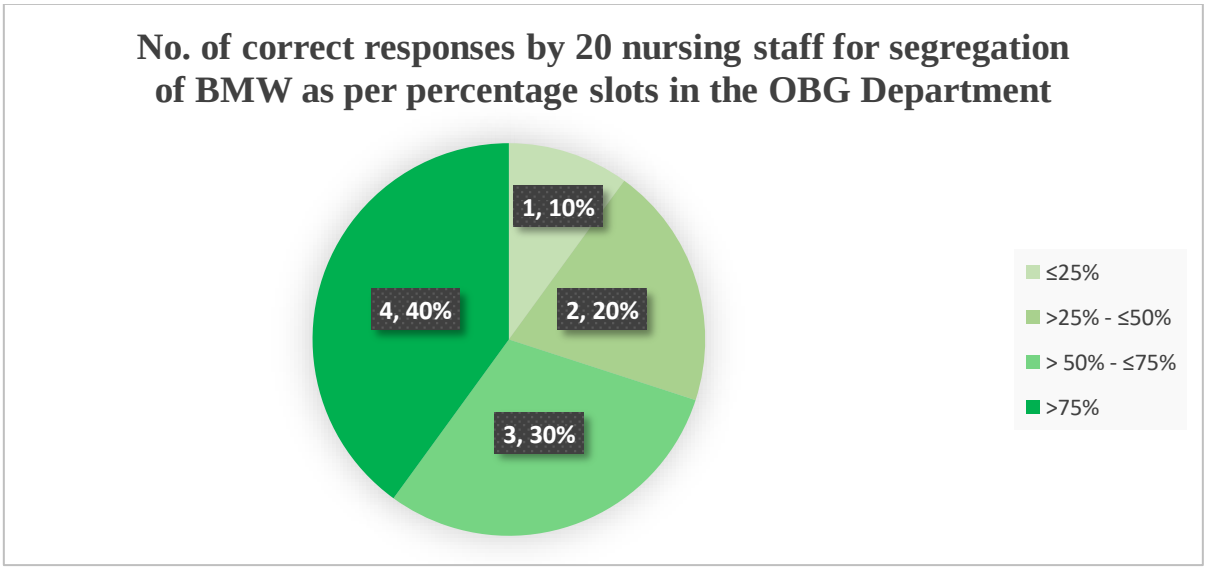
The graph shows that between more than 50% and less than & equal to 75%, the correct responses are 3 and for more than 75%, the correct responses are also 3, that **means 30% responses are correct for >75% and 60% responses are correct for >50%, which indicates that the level of awareness of nursing staff is high,** towards the segregation of BMW according to BMWM Rules 2016 in the ICU in KMC.

3. OBSTETRICS & GYNAECOLOGY DEPARTMENT:

In the Obstetrics & Gynaecology Department, the total participants were 20 in which 2 participants have age below 20 years, 15 participants come under the age group 20-30 years and 2 participants come under the age group 31-40 years, and 1 participant has age above 40 years. Whereas, in the total 20 participants, work experience of 2 participants is below one year, 6 participants have work experience within 1-3 years, 8 participants have work experience within 4-6 years and 4 participants have work experience more than 6 years.

MCQ	No. of correct responses by total no of participants
≤25%	1 (10%)
>25% - ≤50%	2 (20%)
> 50% - ≤75%	3 (30%)
>75%	4 (40%)

Table-6: Correct responses for awareness level of the participants in the OBG Department.



Graph-6: Correct responses for awareness level of the participants in the OBG Department.

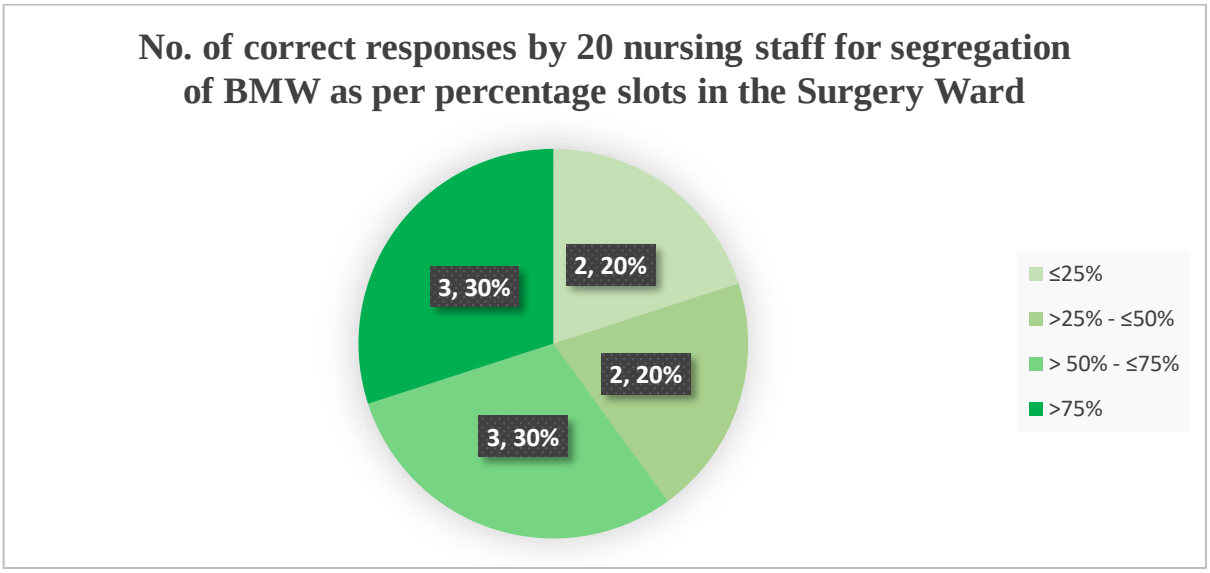
The graph shows that between more than 50% and less than & equal to 75%, the correct responses are 3 and for more than 75%, the correct responses are 4, that means **40% responses are correct for >75% and 70% responses are correct for >50%, which indicates that the level of awareness of nursing staff is very high,** towards the segregation of BMW according to BMWM Rules 2016 in the OBG Department in KMC.

4. SURGERY WARD:

In the Surgery Ward, the total participants were 20 in which the age group of 14 participants come under the age group 20-30 years, 3 participants come under the age group 31-40 years, and 3 participants have age above 40 years. Whereas, in the total 20 participants, 5 participants have work experience within 1-3 years, 1 participant has work experience within 4-6 years and 14 participants have work experience more than 6 years.

MCQ	No. of correct responses by total no of participants
≤25%	2 (20%)
>25% - ≤50%	2 (20%)
> 50% - ≤75%	3 (30%)
>75%	3 (30%)

Table-7: Correct responses for awareness level of the participants in the Surgery Ward.



Graph-7: Correct responses for awareness level of the participants in the Surgery Ward.

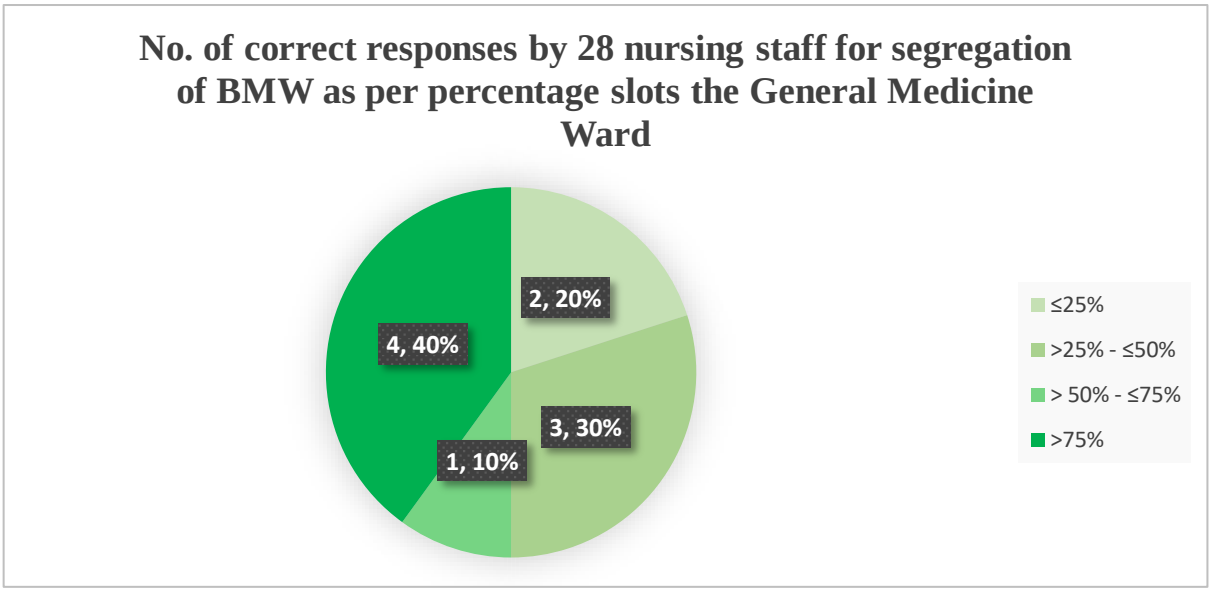
The graph shows that between more than 50% and less than & equal to 75%, the correct responses are 3 and for more than 75%, the correct responses are also 3, that **means 30% responses are correct for >75% and 60% responses are correct for >50%, which indicates that the level of awareness of nursing staff is high,** towards the segregation of BMW according to BMWM Rules 2016 in the Surgery Ward in KMC.

5. GENERAL MEDICINE WARD:

In the General Medicine Ward, the total participants were 28 in which 16 participants come under the age group 20-30 years, 10 participants come under the age group 31-40 years, and 2 participants have age above 40 years. Whereas, in the total 28 participants, work experience of 3 participants is below one year, 9 participants have work experience within 1-3 years, 6 participants have work experience within 4-6 years and 10 participants have work experience more than 6 year

MCQ	No. of correct responses by total no of participants
≤25%	2 (20%)
>25% - ≤50%	3 (30%)
> 50% - ≤75%	1 (10%)
>75%	4 (40%)

Table-8: Correct responses for awareness level of the participants in the General Medicine Ward.



Graph-8: Correct responses for awareness level of the participants in the General Medicine Ward.

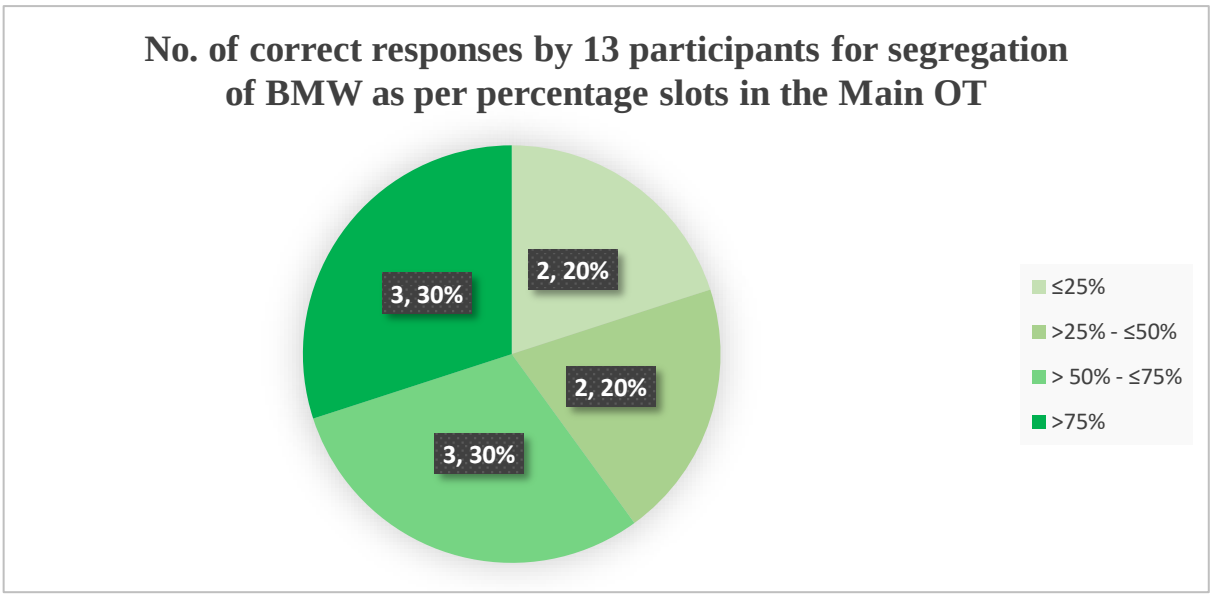
The graph shows that between more than 50% and less than & equal to 75%, the correct response is 1 and for more than 75%, the correct responses are 4, that means **40% responses are correct for >75% and 50% responses are correct for >50%, which indicates that the level of awareness of nursing staff is low,** towards the segregation of BMW according to BMWM Rules 2016 in the General Medicine Ward in KMC.

6. MAIN OPERATION THEATER (OT):

In the Main OT, the total participants were 13 in which 1 participant has age below 20 years, 4 participants come under the age group 20-30 years, 4 participants come under the age group 31-40 years, and 4 participants have age above 40 years. Whereas, in the total 13 participants, 4 participants have work experience within 1-3 years, 3 participants have work experience within 4-6 years and 6 participants have work experience more than 6 years.

MCQ	No. of correct responses by total no of participants
≤25%	2 (20%)
>25% - ≤50%	2 (20%)
> 50% - ≤75%	3 (30%)
>75%	3 (30%)

Table-9: Correct responses for awareness level of the participants in the Main OT.



Graph-9: Correct responses for awareness level of the participants in the Main OT.

The graph shows that between more than 50% and less than & equal to 75%, the correct responses are 3 and for more than 75%, the correct responses are also 3, that means **30% responses are correct for >75% and 60% responses are correct for >50%, which indicates that the level of awareness of nursing staff is high,** towards

the segregation of BMW according to BMWM Rules 2016 in the Main OT in KMC.

RESULT:

In the all the six departments, the parameters like bins are at right place, bins are in standing position, and bins are collected daily were followed properly, whereas bins are with closed fitting cover was not appropriately followed by the staff. The IC protocols were least followed for **white bins** regarding all the observational parameters by the staff in KMC in all six departments, **except for the bins with closed fitting cover.**

In the study, it is found that the white colour bins were least available as a whole in comparison to other colour coded bins because in department likes ICU, the white bin was least available for BMWM. In Main OT also white bin didn't available properly throughout the observation period of 40 days. During observation period, it was found that the availability of **blue bins with closed fitting cover was least i.e. only 86 (35.83%)** as a whole because in departments like Surgery Ward, OBG Ward, and General Medicine Ward, the blue colour bins were not properly available with closed fitting cover. Even in Emergency Department, the blue colour bin was only closed for 7 days in total 40 days of observations.

The **overall** awareness level i.e. knowledge, attitude and practices of all the participants towards the segregation of BMW according to BMWM Rules 2016 is **low** i.e., 50%.

In Emergency Department, 60% responses are correct for >50%, so the overall awareness level of the all participants regarding segregation of BMW according to BMWM Rules, 2016 is high; likewise in ICU is high, in OBG Department is very high, in Surgery Ward is high, in General Medicine Ward is low, & in Main OT is high.

DISCUSSION:

In this study, it was found that there was an inconsistency in segregation of BMW when compares among all five colour coded bins that were included in the research. This shows that BMWM Rules 2016 was inadequately followed for the availability of colour coded bins at the source of generation of BMW in KMC. During observation period, it was found that the availability of blue bins with closed fitting cover was least i.e. only 86 (35.83%) as a whole. The IC protocols were least followed for white bins regarding all the observational parameters, except for the bins with closed fitting cover.

One such study in tertiary care hospital in Andhra Pradesh [14] revealed that the first and prime step in the BMWM is the segregation of BMW. The BMW requires proper monitoring at all times for effective tracking. The BMWSD index can be used for IC practice as an indicator. For minimizing inappropriate handling and segregation of BMW, there is a need to train all BMW handlers on methods and new techniques for effective waste management practices using WHO manual and PPE.

In another study conducted in South Indian tertiary care hospital [9] revealed that regarding colour coding, the study identified the potentially-infected red colour category (>50%) was more than blue followed by yellow in all the years of the study. For handling BMW, a safe and reliable method is essential. By doing proper segregation of waste where it is generated can minimize the generation of waste. The study finds the reduction in the generation of BMW in Coimbatore Medical College, Coimbatore same as a study by WHO in India because of adequate segregation of BMW. Various studies on the knowledge and attitude towards segregation of BMW were conducted previously that revealed in tertiary care hospital [15] BMWM's understanding and practices were inadequate and inconsistent across all HCWs domains. For advancing the BMWM knowledge and practices of healthcare professionals, with special focus on the nursing staff, the ongoing training programs and periodic sensitization is necessary for ensuring the effective implementation of BMWM procedures in the hospitals.

Another study in a tertiary care teaching hospital [13] revealed that among the samples examined, 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. To implement the BMWM Rules, the periodic training and focused on the implementation of the policies related to the segregation of BMW for all HCWs is crucial to optimize the compliance to effective segregation, daily surveillance, stern supervision and inspections are recommended. Likewise, in Puducherry Government General Hospital [11] revealed that the research point outs the vital points to be corrected for the BMWM. In the Puducherry Government General Hospital, the study aided in initiating a database, information and statistics on the BMWM. The result of the study applicable in the majority of cities in India, wherever the regulations for BMW are not strictly applied. The requirement of training programs for distinct levels of hospital staff in BMWM is indicated.

Finally, the present study identifies that in KMC, the knowledge, attitude and practices among the participants for the segregation of BMW according to BMWM Rules 2016 is low because correct responses given by all the participants for more than and equal to 50% (≥50%) is 50%, which indicates that the regular training to update the knowledge about segregation of BMWM is necessary among the participants.

The limitation of this study is that the study is only done in the six departments in KMC, other departments are untouched during the research. The study is focused on the nursing staff and OT technicians and other HCWs like doctors, paramedical staff etc. and medical students are not included in the study.

In future, the study based on various parameters other than BMWM that is included in this study related to IC protocols and HAIs will be recommended so that the comprehensive information regarding HAIs and the present situation in KMC adherence to IC protocols other than BMWM will be evaluated.

CONCLUSION:

The proper availability of colour coded bins at the place of generation of BMW is necessary so that the IC protocols is effectively followed to minimize HAIs and to maintain healthy environment. The study reveals that the availability of colour coded bins in the departments where research was done have not presented properly. In a few departments, for all the five colour coded bins i.e. red, yellow, white, blue & black, the staff were not followed all the parameters that were included in the study properly for the segregation of BMW as per BMWM Rules 2016 in KMC. The hospital management and the BMWM committee should focus on that issue so that HAIs was minimized and the quality of services in KMC increases. Segregation of BMW is the first step of BMWM so that if the proper colour coded bins were not available at the place of generation of BMW properly then the whole process from segregation to disposal of BMW will be disturbed which leads to inappropriate BMWM.

The overall knowledge and attitude about segregation of BMW according to BMWM Rules 2016 among the participants was low, which reveals that in KMC, the regular training, supervision, daily surveillance, inspections and performance appraisal would be needed for the staff who were handling the BMW. The updated information would boost the knowledge, attitude and skills of the BMW handlers, and the execution of various research studies in this area would fill the gap for the segregation of BMW in KMC. It is the duty of the staff to know about safe handling and ensure proper segregation of BMW.

The study suggests that the management of KMC should focus on the awareness about the BMWM so frequent audit is recommended to implement BMWM guidelines in the hospital because involvement and concern of hospital administrators and regular appraisal with the status of BMWM in waste management and quality control committee play a very important role in implementing the IC protocols effectively. The study recommends that BMWM manual must be available in KMC so that the staff should follow the protocols regarding BMWM Rules, 2016 effectively.

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