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A Study to Assess the Effectiveness of Lecture-Cum-Demonstration on Knowledge and Practice Regarding Biomedical Waste Management Among Allied Health Science Students at GIMS, Gadag

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Abstract

Background: *Biomedical waste management is a critical aspect of healthcare practice, and inadequate knowledge and poor handling can pose serious risks to health professionals, patients, and the environment. Allied Health Science students, as future healthcare providers, must be well-versed in the principles and practices of biomedical waste management. This study aims to assess the effectiveness of a lecture-cum-demonstration program on improving knowledge and practice related to biomedical waste management among Allied Health Science students at GIMS, Gadag.* ***Objectives:*** *(1) To assess the baseline knowledge and practices regarding biomedical waste management among Allied Health Science students. (2) To evaluate the impact of a lecture combined with a demonstration on biomedical waste management among Allied Health Science students. (3) To examine the relationship between post-test knowledge and practice scores and selected socio-demographic variables of the students.* ***Methodology:*** *The study adopts an evaluative research approach with a one-group pre-test and post-test design (quasi-experimental). The source of data was Allied Health Science students enrolled at the GIMS Institute, Gadag. A structured questionnaire and observation checklist was used to collect data on students' knowledge and practices before and after the educational intervention. Statistical* ***Methods:*** *Descriptive statistics such as frequency, mean, median, mode, and standard deviation was used to assess the levels of knowledge and practice regarding biomedical waste management. The paired 't'-test was employed to determine the effectiveness of the lecture-cum-demonstration intervention. Additionally, the chi-square test was used to analyze the association between post-test scores and selected socio-demographic variables.* ***Conclusion:*** *This study is expected to provide insight into the current awareness and practice levels of biomedical waste management among Allied Health Science students and demonstrate the effectiveness of structured educational interventions in enhancing compliance with standard waste management protocols.*

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Keywords: Biomedical waste management, allied health science students, educational intervention, knowledge and practice, lecture-cum-demonstration

INTRODUCTION

"Let the Wastes of the Sick Not Contaminate the Lives of The Healthy"

Waste is defined as any unwanted or unusable material, generally regarded as having no further utility. It is generated from multiple sources such as households, commercial establishments, industries, agricultural practices, and others [1].

Wastes can be categorized into seven major types commonly encountered in daily life: liquid, solid, organic, recyclable, hazardous, industrial, and biomedical waste [2]. Biomedical waste (BMW), also referred to as hospital waste, includes any material containing infectious or potentially infectious substances generated during the treatment of humans or animals, as well as from research involving biological materials [3].

The collection and proper disposal of biomedical waste has become a significant concern for both the general public and the medical community. Presently, about 15% of biomedical waste is considered hazardous, posing risks to the health of both medical personnel and the wider community. Since medical students are future professionals, they will inevitably become integral to the health care system [4].

Improper handling of biomedical waste can lead to serious public health consequences and environmental hazards. Around 75–90% of biomedical waste is non-hazardous, while the remaining 10–25% is hazardous and harmful to humans, animals, and the environment. If both types are mixed, the entire waste stream becomes dangerous. In India, it is estimated that nearly 0.33 million tons of hospital waste is produced annually, with waste generation ranging between 0.5 and 2.0 kg per bed per day [5].

The issue of biomedical waste management has gained prominence in recent years, especially with the rising prevalence of HIV infection. To address this, the Government of India made proper handling and disposal of biomedical waste a statutory requirement through Gazette Notification No. 460 dated 27 July 1998. These provisions apply to all service hospitals, necessitating the medical, dental, and nursing officers, as well as paramedical staff and sanitation workers, being knowledgeable about the principles of biomedical waste handling, treatment, and disposal [6].

According to the Biomedical Waste Rules (1998), any person or institution involved in generating or disposing of biomedical waste must possess adequate knowledge, practice, and capacity to guide others in its collection, segregation, and handling. Effective biomedical waste management is not only a legal obligation but also a social responsibility. Segregation of biomedical waste should occur at the point of generation using appropriate containers or bags. Color coding for disposal includes yellow, red, blue, and black containers. Treatment and disposal methods include incineration, chemical disinfection, wet and dry thermal treatment, microwave irradiation, land disposal, and inertization [4].

Medical waste is hazardous due to its potential for disease transmission, toxicity, and environmental harm. Biomedical waste management focuses on minimizing waste generation, ensuring efficient collection, handling, and safe disposal practices that prevent infection and safeguard health care workers and the community [7].

NEED FOR THE STUDY

Disposing of Waste is Not a Chore, it is A Responsibility to Secure Our Future

Health threats are not confined by borders. In today's era of globalization, international trade, and rapid technological advancement, both new and existing diseases can easily cross boundaries, posing risks to collective security. Hospital waste has emerged as an additional threat to health in this context [8].

The volume of hospital waste generated varies depending on hospital policies, practices, and the type of care delivered. In developed countries, waste generation ranges around 1.5 kg per patient per day, whereas in developing countries it is between 1 and 2 kg per patient per day. According to the World Health Organization (WHO), approximately 85% of hospital waste is general and non-hazardous, 10% is infectious, and the remaining 5% is non-infectious but hazardous [9].

A survey by the National Environmental Engineering Research Institute (1997) revealed that health care waste generation in middle- and low-income countries is lower than in high-income countries.

Among this waste, 80% constitutes general health care waste, 15% is pathological and infectious waste, 1% is sharps, and 3% consists of chemical and pharmaceutical waste [1]. In India, the estimated hospital waste generation is about 1.59–2.2 kg per bed per day, of which 10–15% is biomedical waste [9]. In Karnataka, hospital waste ranges from 0.5–4 kg per bed per day, totaling nearly 40 t daily. The increasing challenge of biomedical waste disposal has led hospital administrations to seek safer, more scientific, and cost-effective management methods [10].

Recent reports indicate that around 656 t of biomedical waste were generated daily in 2020, of which 590 t were collected and treated by Common Biomedical Waste Treatment Facilities (CBWTFs). Additionally, from May 2020 to February 2022, about 84.61 t of additional COVID-19-related biomedical waste was produced in India from healthcare institutions, quarantine facilities, testing centers, laboratories, and home isolation units involved in managing suspected or confirmed COVID-19 cases. This was reported by the Minister of State for Environment, Ashwini Kumar Choubey, in a written reply to the Lok Sabha [11]. The characteristics of the health care waste that make it a health risk are infectious agents, toxic chemicals and sharps, which render it as highly infectious, flammable, genotoxic, cytotoxic and radioactive. Each year, out of a total of 1.2 billion infections worldwide, an estimated 8–10 million cases of hepatitis B, 2.3 to 4.7 million cases of hepatitis C, and 80,000 to 160,000 cases of HIV are attributed to the reuse of syringe needles without proper sterilization [12].

A descriptive cross-sectional study was conducted in a teaching hospital in Nepal among medical and nursing students. A self-administered, predesigned, and pretested questionnaire was used to assess their knowledge, attitudes, and practices regarding biomedical waste (BMW) management. A total of 140 participants took part, comprising 70 final-year MBBS students and 70 third-year nursing students.

The findings showed that medical students possessed significantly higher knowledge about most aspects of BMW management compared to nursing students ($p<0.05$). Awareness of BMW management rules was reported in 80% of medical students, whereas only 40% of nursing students were aware of them. All medical students (100%) demonstrated excellent knowledge regarding the health hazards of BMW, while only 64.3% of nursing students shared the same awareness.

Furthermore, more than 95% of medical students were knowledgeable about the types and sources of BMW, the biohazard symbol, and universal precautions. In contrast, only 40% of nursing students recognized the biohazard symbol, and about 60–80% were aware of the types and sources of BMW and universal precautions. However, when comparing the knowledge of both groups regarding color coding of containers and segregation practices, the difference was not statistically significant [13]. A study was conducted in Bangalore city to assess the occupational health and safety measure in some selected health care institutions, in which total 88 HCI (health care institution) were selected and relevant information was collected by head of the institution regarding PPE (Personal protective equipment) through direct observation, interaction and discussion with health care workers. This study reveals that PPE, namely gown, gloves and masks were practiced by only 1/3rd of HCIs; and among that doctors wear gown about 35%, gloves 48% and mask about 4%; nurses wear 0% gown, 43% gloves and 2% mask; and technician wear the 15% gown 6% mask and 5% gloves. This reveals that the practice of using gowns or gloves among lab technicians was found to be very low.

Improper management of waste can result in environmental pollution, foul odors, and the breeding of disease vectors such as insects, rodents, and worms, which may subsequently cause illnesses like typhoid, cholera, hepatitis, and even AIDS. The concept and principles constitute the core for management of health care waste, which are polluter pays principles, precautionary principles, duty of care, waste reduction, recycling and reuse, environmentally sound treatment and disposal of waste and proximity principle [12].

Based on the review of literature and observation, the investigator concluded that the Allied health science students had inadequate knowledge and practice regarding biomedical waste management. The

researcher recognized the necessity of providing students with information on biomedical waste management [14].

OBJECTIVES

- To assess baseline knowledge and practices related to biomedical waste management among allied health science students.
- To determine the effectiveness of a lecture combined with demonstration on biomedical waste management for allied health science students.
- To examine the association between post-test knowledge and practice scores of allied health science students and their selected socio-demographic variables.

HYPOTHESIS

- *H1:* There is a significant difference between pretest and posttest knowledge regarding biomedical waste management among allied health science students.
- *H2*: There is a significant difference between pretest and posttest practice regarding biomedical waste management among allied health science students.
- *H3*: There is significant correlation between knowledge and practice regarding biomedical management among allied health science students.
- *H4*: There is significant association between posttest knowledge and practice score on biomedical waste management among allied health science students with their selected demographic variables.

VARIABLES

- *Independent variable*: Lecture-cum-demonstration on biomedical waste management.
- *Dependent variable*: Knowledge and practice of allied health science students on biomedical waste management.
- *Demographic variables*: Age, gender, socioeconomic status, religion, year of study, branch, source of information.

OPERATIONAL DEFINITIONS

Lecture-Cum-Demonstration

- *Lecture:* It is formal, verbal presentation of information or other material by an instructor to a group of learners.
- *Demonstration:* It is a method of teaching by exhibition and explanation or presentation of skills which shows how a particular procedure is performed.
- *Knowledge*: In this study, it denotes the knowledge and awareness of allied health science students about biomedical waste management.
- *Practice*: In this study it refers to activity performed by allied health science students for biomedical waste management.
- *Biomedical waste management*: In this study it refers to systematic and scientific way of managing the healthcare waste through a step-by-step process such as segregation, storage, transportation, and disposal.
- *Allied health science students*: Students who are healthcare providers other than physicians or nurses, whose primary role is to deliver health and allied services to patients.

ASSUMPTIONS

- Allied health science students may possess insufficient knowledge regarding biomedical waste management.
- Providing a lecture combined with demonstration may enhance both knowledge and practices related to biomedical waste management among allied health science students.

DELIMITATIONS OF THE STUDY

Study is delimited for:

- Allied health science students studying at GIMS, Gadag.
- Sample size is limited to 54.

CONCEPTUAL FRAMEWORK

A conceptual framework presents a logically structured set of concepts that help explain the relationships among variables in a research study. It serves as a foundation for research, guiding the development of research tools, data collection, and interpretation of results. Conceptual frameworks are often drawn from existing theories or models and shaped by the researcher's own experiences and a review of related literature (Figure 1).

The present study, "A Study to Assess the Effectiveness of Lecture-cum-Demonstration on Knowledge and Practice Regarding Biomedical Waste Management Among Allied Health Science Students at GIMS Gadag", is undertaken with the aim of developing an information booklet to enhance safe biomedical waste handling practices. The conceptual framework adopted for this study is based on Roy's Adaptation Model (1976), developed by Sister Callista Roy.

Roy's Adaptation Model views individuals as holistic adaptive systems who respond to environmental changes through adaptive or maladaptive responses. The goal of nursing, according to this model, is to promote adaptation in the four modes of functioning: physiological, self-concept, role function, and interdependence.

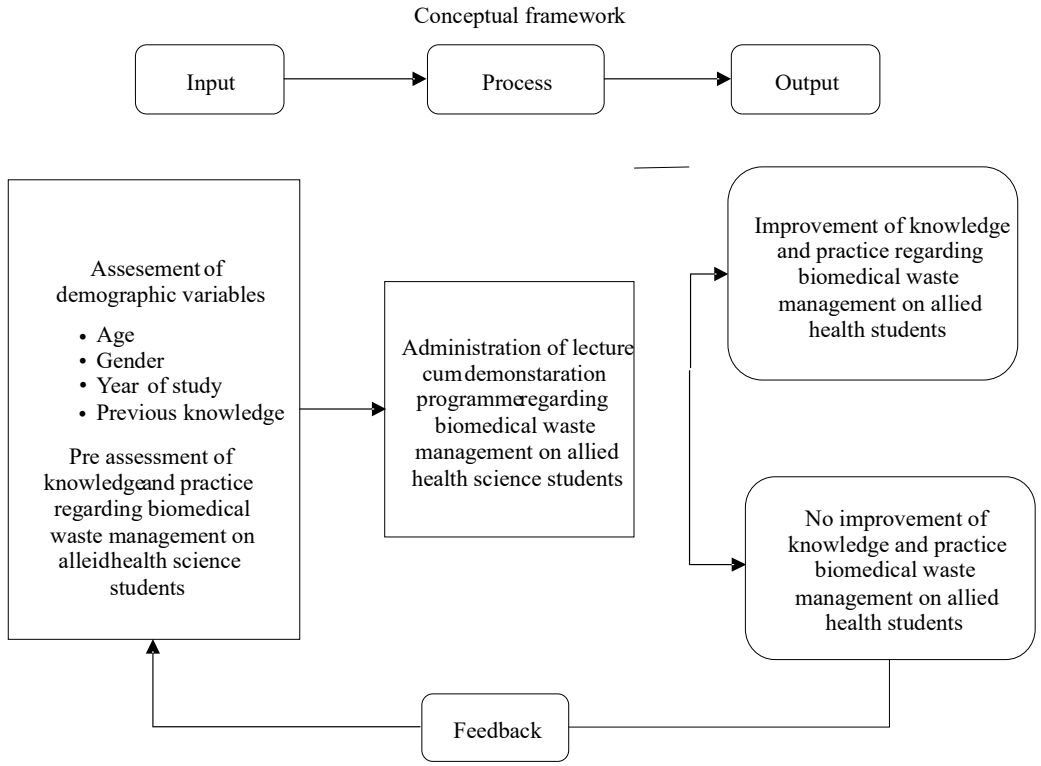

Figure 1. Conceptual framework based on general systems theory (Ludwig von Bertalanffy, 1968).

Key Elements of Roy's Adaptation Model

The model contains five essential elements:

1. *The person (patient):* Considered as a bio-psycho-social being constantly interacting with a changing environment. In this study, the Allied Health Science students are the adaptive system.

2. *Health*: A state and process of being and becoming integrated and whole; this is reflected in improved knowledge and practice of biomedical waste management.
3. *Environment*: All internal and external conditions that influence the student nurses, including the clinical and academic setting.
4. *Goal of nursing*: To promote adaptive responses to improve health; in this study, to improve student adaptation in biomedical waste management through education.
5. *Direction of nursing activities*: Interventions aimed at enhancing adaptation. Here, it is the lecture-cum-demonstration and development of the information booklet.

Three Components of the Model Applied to This Study

1. *System*: The system in this study refers to the Allied Health Science students at GIMS, Gadag. A system is defined as a set of organized, interacting, and interdependent components forming a unified whole. The students represent the system reacting to stimuli from their learning environment.
2. *Mechanisms*: These are the internal processes or coping strategies activated in response to external stimuli. In this case, the mechanisms involve cognitive processes like knowledge acquisition and skill development triggered by the lecture-cum-demonstration.
3. *Adaptive methods*: These are the outcomes or observable behaviors resulting from internal mechanisms. In the study, adaptive responses include improved knowledge and safe biomedical waste management practices, as measured in the post-test evaluation.

By applying Roy's Adaptation Model, this study examines how educational interventions can serve as stimuli that trigger adaptive mechanisms, ultimately resulting in improved practices and behaviors among Allied Health Science students. The model helps explain the impact of structured educational strategies on professional development and responsible biomedical waste handling in healthcare settings.

INPUT-THROUGHPUT-OUTPUT

Component and Definition

Application of Roy's adaptation model in the present study

In this study, Roy's Adaptation Model is modified and utilized to assess the knowledge regarding the importance of Rainbow Nutrition among school children. The model includes three main components: Input, Throughput, and Output. These components have been adapted for the context of this research as follows:

Input

In the original Roy's Adaptation Model, input is defined as the stimuli that come from the environment or from within the person. It also includes the adaptation level, which is unique and constantly changing for each individual based on factors such as growth, reproduction, and mastery.

In this study, input refers to the demographic variables of high school students, including:

- Age,
- Gender,
- Economic status,
- Religion,
- Type of family, and
- Parents' education and occupation.

These factors are used to assess the pre-test knowledge level regarding the importance of Rainbow Nutrition.

Throughput

In Roy's model, throughput refers to the internal processes that individuals use to adapt. This includes:

- *Processes*: The control mechanisms or cognitive strategies involved in adaptation.

- *Effectors*: Physiological functions, as well as elements such as self-concept and role function.

In this study, throughput represents the intervention process, that is, the exhibition program conducted to enhance students' knowledge about Rainbow Nutrition. It involves the ability to monitor, adjust, and deliver information effectively to stimulate learning and awareness.

Output

In the original model, output refers to the behaviors or responses exhibited by the individual as a result of the input and throughput processes. These are categorized as:

- *Adaptive responses:* Behaviors that support survival, growth, reproduction, and mastery.
- *Ineffective responses*: Behaviors that do not support adaptation.

In this study, output is measured as the post-test knowledge scores of the students after the intervention. These scores are assessed using a structured knowledge questionnaire and are categorized into three levels:

- No Enhancement,
- Moderate Enhancement, and
- Enhancement.

These outcomes reflect the effectiveness of the exhibition program and provide feedback for further improvements.

REVIEW OF LITERATURE

Reviewing literature is a vital component in the development of a research project. It provides a deeper understanding of the research problem and informs the researcher about previous studies conducted on the topic. It also helps researchers become familiar with existing work and serves as a foundation for selecting appropriate methodology, data collection tools, and research design.

Studies Related to Knowledge on Biomedical Waste Management

A quasi-experimental study was conducted from September 2021 to May 2022, involving 5th-year medical students enrolled at the Faculty of Medicine of Monastir, Tunisia. The study utilized the WHO knowledge questionnaire along with the "Biomedical Waste Management Audit", validated by the Hospital Infection Control Committee in France. A total of 203 medical students participated, with 105 in the control group and 98 in the experimental group, and a mean age of 23±0.7 years.

The results demonstrated a statistically significant increase in post-test scores for all training methods. The student-centered approach produced a higher post-test mean score (14.1±1.9) compared to conventional methods (13.9±2.3). Overall, the improvement in knowledge was greater following the student-centered method. The study concluded that combining student-centered teaching with continuous supervision can enhance both hand hygiene and biomedical waste management knowledge and practices among medical students [14].

A cross-sectional study was conducted among 75 participants, including MBBS students, interns, and postgraduate students (25 from each group) at King George's Medical University, Lucknow, using purposive sampling over one month. Data were collected via a structured self-administered questionnaire and analyzed using chi-square, Fisher's exact test, one-way ANOVA, and post hoc (Tukey) tests. The results indicated that MBBS students had greater knowledge and a more positive attitude toward biomedical waste (BMW) management guidelines compared to interns and postgraduates ($p<0.01$), whereas postgraduate students were more aware of needle-stick injuries and practiced BMW management correctly compared to MBBS students and interns ($p<0.001$). The study concluded that knowledge, attitude, and practices regarding BMW management remain inadequate among all groups, highlighting the need for repeated training, supportive supervision, strict regulations, and periodic inspections [15].

Another cross-sectional study conducted in 2017–2018 among medical and nursing college students used a pretest–posttest design with a structured questionnaire. Among 600 participants, 51% of medical students and 75% of nursing students could not correctly identify the definition of standard precautions. Additionally, 65% of medical students (275/423) and 82% of nursing students (145/177) were unaware of post-exposure prophylaxis. Overall, knowledge regarding personal protective equipment (PPE) and hazard symbols was poor (<25%). While theoretical knowledge about hand hygiene was high (510/600; 85%), its practical implementation was low (<30%). About 65% of participants incorrectly believed that using hand rub replaced handwashing, and some felt that PPE use might offend patients. High workload and insufficient knowledge were major barriers to compliance with standard precautions [16].

A cross-sectional study among dental students from all dental colleges in Bhubaneswar, Odisha, India, was conducted from February to April 2016. A total of 500 students (208 males and 292 females) participated in two phases. A questionnaire assessed awareness of biomedical waste management and knowledge of effective recycling of dental materials, with responses analyzed on a 5-point unipolar scale. The results revealed that 44% of dental students had no awareness of biomedical waste management, 22% were moderately aware, 21% slightly aware, 7% very aware, and 5% extremely aware. Regarding recycling and reusing dental materials, 61% were completely unaware. The study concluded that dental students lack sufficient knowledge about biomedical waste management and recycling, emphasizing the need for enhanced academic training to improve awareness during their courses [17].

Studies Related to Practice on Biomedical Waste Management

A study conducted at Balrampur Hospital, a major healthcare facility in Lucknow, North India, highlighted the biomedical waste management practices in the hospital. The findings revealed that infectious and non-infectious wastes were often mixed and disposed of together in municipal waste at city dumping sites. All types of waste were collected in a single bin placed outside patient wards, and the hospital relied on the Lucknow Municipal Corporation for disposal, with collection typically occurring every 2–3 days. Laboratory waste was discharged directly into the municipal sewer without proper disinfection, eventually reaching the Gomti River. Waste was either placed in hospital dustbins or community bins for further transport and disposal along with municipal solid waste. Open dumping made the waste accessible to rag pickers, exposing them to serious health hazards from sharps, needles, and other materials used in medical procedures. The study emphasized the urgent need for strict enforcement of legal regulations and improved environmental management systems for biomedical waste disposal at Balrampur Hospital and other healthcare facilities in Lucknow [18].

An experimental study in Al-Ahsa assessed the knowledge, attitudes, and practices of healthcare professionals (HCPs) regarding biomedical waste management during the COVID-19 pandemic, which posed major challenges for the healthcare sector. A total of 256 HCPs, including physicians, nurses, and respiratory therapists, were randomly selected. The results indicated that 105 HCPs had excellent knowledge, 87 had good knowledge, and 64 had poor knowledge regarding biomedical waste management. In terms of practice, 72 HCPs properly used and disposed of PPE while handling biomedical waste, and 88 consistently followed correct hygiene protocols before and after procedures as needed. The study highlighted the need for targeted training of all HCPs to ensure proper biomedical waste management during the pandemic to prevent infection transmission [19].

Studies Related to Lecture-Cum-Demonstration on Biomedical Waste Management

A structured questionnaire was administered to 434 dental students (323 males and 111 females) from five different dental colleges in Nepal. The first part of the questionnaire collected demographic information, while the second part assessed knowledge, attitudes, and practices regarding biomedical waste (BMW) management. Chi-square tests were used to examine associations between responses from different colleges. The results showed that a majority of participants (91.82%) had a positive attitude toward safe BMW management. While 83.1 to 98.9% of students demonstrated positive

attitudes toward BMW management, over 50% were unaware of government-implemented guidelines in Nepal. Awareness of hospital biomedical waste disposal techniques ranged from 29.9 to 79.8%, indicating a lack of strict protocols. The association between colleges and responses revealed that 93.3 to 98.9% of participants recognized that improper waste management could lead to various health hazards [20].

A cross-sectional study in Allahabad assessed knowledge, attitudes, and practices regarding BMW management among doctors (75), nurses (60), lab technicians (78), and sanitary staff (70). The study found that doctors, nurses, and lab technicians had better knowledge than the sanitary staff. In terms of knowledge about color coding and waste segregation, nurses and lab technicians outperformed doctors. Regarding actual practices, sanitary staff showed significant gaps in proper BMW handling. The study concluded that focused training is essential, as inadequate knowledge directly affects appropriate biomedical waste disposal practices [21].

A true experimental study evaluated and compared the effectiveness of lecture-cum-demonstration versus lecture-cum-video-assisted teaching for undergraduate nursing students at a selected nursing institution in Dehradun, India. Using simple random sampling, 60 students were selected from a total of 100. Pre-test and post-test results indicated that the video-assisted teaching method was more effective than the demonstration method [22].

A pre-experimental study was conducted among 50 school students in Pune to assess the effectiveness of lecture-cum-demonstration on first aid knowledge and practice. A purposively selected sample was administered a questionnaire, and pre-test and post-test scores were compared. The findings showed an increase in knowledge scores from 58.4% (pre-test) to 66.3% (post-test), demonstrating that lecture-cum-demonstration effectively enhanced knowledge and management skills among the participants [23].

A study was conducted to evaluate the effectiveness of lecture-cum-demonstration on first aid measures for minor ailments among primary school teachers in a selected school at Charapakkam block, Kancheepuram. The objective was to assess how lecture-cum-demonstration influenced teachers' knowledge and skills regarding first aid for minor ailments.

A total of 30 teachers participated in the study. Data were collected following a systematic research methodology to ensure valid and reliable results. The findings indicated that some teachers were unwilling to participate, and some participants were from outside the Charapakkam block. The study concluded that lecture-cum-demonstration was effective in improving primary school teachers' knowledge and skills in first aid for minor ailments [24].

A comparative study assessed the effectiveness of video-assisted teaching versus lecture-cum-demonstration on bag technique practice among 40 2nd-year BSc nursing students. The objective was to evaluate students' practice scores using an 18-step bag technique checklist after training. The participants were divided into two groups of 20, and data were analyzed using descriptive and inferential statistics, including frequency, mean, standard deviation, paired t-tests, and independent t-tests. The results revealed that 8 students (40%) demonstrated a good level of practice, 2 students (5%) achieved an excellent level, and the remainder showed an average level of practice. The study concluded that both teaching methods enhanced BSc nursing students' practical skills in bag technique.

METHODOLOGY

Research methodology refers to the systematic process employed by a researcher, encompassing the research approach, study setting, population, sampling technique, sample selection, inclusion and exclusion criteria, development of tools and content, validation and reliability of tools, pilot study, data collection procedures, and the plan for data analysis.

Research Approach

The research approach provides the overall framework for conducting a study, guiding how data will be collected and analyzed. Considering the nature of the selected problem and the study objectives, a quantitative evaluative approach was deemed appropriate for the present research.

Research Design

Research design refers to the plan, structure, and strategy used to address research questions. It serves as the overall blueprint that guides the researcher in conducting the study. For the present study, a one-group pre-test and post-test pre-experimental design was selected (Table 1). In this design, a pre-test is administered, followed by a lecture-cum-demonstration, and then a post-test is conducted for the same group after 7 days. The chosen pre-experimental design is illustrated in the study framework (Figure 2).

The term "setting" refers to the location where a study is carried out, including the physical environment and conditions under which data collection occurs. This study was conducted at GIMS Institute of Allied Health Science, Gadag. The setting was selected based on the availability of participants and the feasibility of conducting the study.

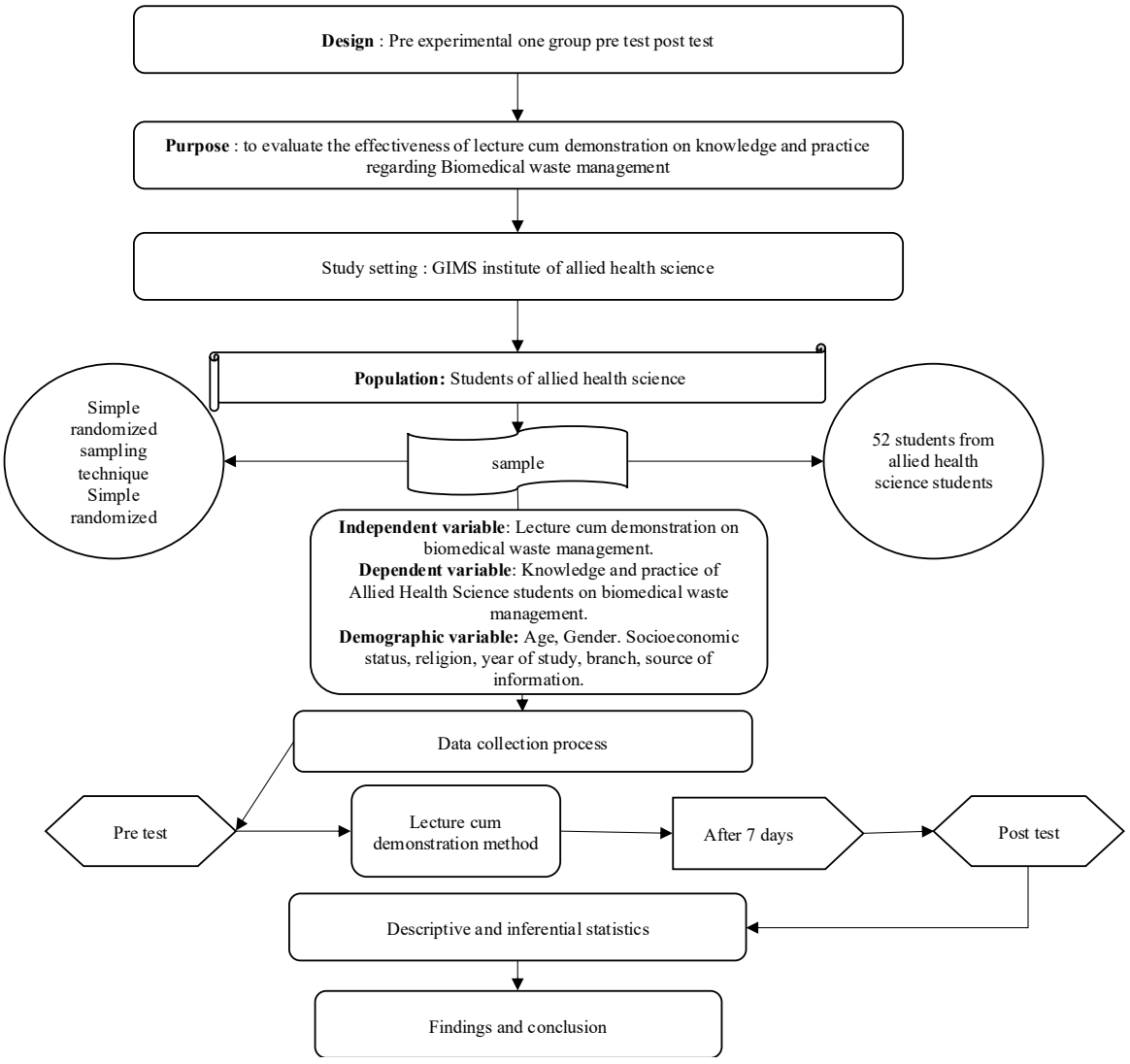

Figure 2. Schematic representation of research plan setting of the study.

Table 1. One group pre-test and post-test pre-experimental design.

Group	Pre-test	Intervention	Post-test
Students of GIMS Institute of Allied Health Science, Gadag	Administration of structured knowledge questionnaire regarding BMW management	Administration of lecture-cum-demonstration on bio medical waste management	Administration of structured knowledge questionnaire regarding BMW management and assess the practice by checklist.
	Day 1	Day 1	
	O1	X	O2

Keys:

- *O1: Conduct pre-test to evaluate students' knowledge and practices related to biomedical waste (BMW) management.*
- *X: Implement a lecture combined with demonstration on biomedical waste management.*
- *O2: Conduct post-test to reassess students' knowledge and practices regarding BMW management.*

Population

Population refers to the entire set of individuals or objects in which the researcher interested in studying. Population in the present study is students of GIMS Institute of Allied Health Science, Gadag.

Sample and Sampling Technique

Sample refers to a subset of population selected to involve in the research study. Sampling refers to the process of selecting a portion of population to represent the entire population. The sample for the study comprised of 54 students of GIMS Institute of allied health science, Gadag, which was selected by using simple random technique (chit method).

Criteria for Selection of Sample

Inclusive Criteria

- Both male and female allied health students are included in the study.
- Allied health science students who can read and write English.
- Allied health science students who are present during the time of study.

Exclusive Criteria

- Allied health science students, who have undergone classes on biomedical waste management.
- Allied health science students who are not willing to participate in the study.

Development of the Lecture-Cum-Demonstration Teaching Program

Steps for Developing the Lecture-Cum-Demonstration Teaching Program:

- *Preparation of the first draft*: The initial draft of the teaching plan on biomedical waste management was created based on the study objectives, an extensive literature review, and expert recommendations.
- *Development of evaluation criteria*: Criteria were established to assess the effectiveness of the lecture-cum-demonstration program.
- *Identification and statement of objectives*: Objectives were formulated in behavioral terms according to the students' abilities.
- *Selection of content*: Relevant content on biomedical waste management was selected through literature review and consultation with the guide and experts.
- *Content validation:* The initial draft of the teaching program, along with the evaluation tool, was submitted to nine field experts. Their suggestions were incorporated to refine the program.
- *Editing*: Necessary modifications were made to improve clarity and coherence.
- *Preparation of final draft*: The final version of the lecture-cum-demonstration teaching program was prepared after integrating all the expert feedback.

Selection and Development of Tool

Treece and Treece (1986) highlighted that the research instrument should ideally serve as an effective means of collecting data to draw valid conclusions. In this study, a structured knowledge questionnaire

was used as the research tool, as it is considered the most suitable method for obtaining responses from the participants.

Selection of the Tool

- A structured knowledge questionnaire was employed to evaluate students' knowledge regarding biomedical waste management.
- A checklist was utilized to assess students' practices related to biomedical waste management.

Development of Tool

The following steps were carried out in preparing the tool:

1. Literature review.
2. Preparation of blueprint.
3. Consultation with the guide, statistician, subject experts of community health nursing.
4. Establishment of validity and reliability.

Description of the Tool

In the present study, the investigator developed a structured tool comprising two main parts to collect relevant data:

Part I: Socio-Demographic Profile and Background Information

This section consists of items designed to collect socio-demographic data and background variables of the participants. It includes the following variables:

- Age,
- Educational status,
- Religion,
- Economic status,
- Educational status of the mother,
- Educational status of the father,
- Occupational status of the mother,
- Occupational status of the father, and
- Whether the mother has received any information regarding the importance of rainbow nutrition.

This section helps in understanding the background and context of the respondents, which may influence their knowledge and practice regarding biomedical waste management.

Part II: Knowledge and Practice Assessment on Biomedical Waste Management

This section is divided into two components*:*

Knowledge Questionnaire:

This part consists of 30 structured multiple-choice questions aimed at assessing the knowledge of participants regarding biomedical waste management. These questions cover the following aspects:

- *Aspect 1:* General information and concepts related to biomedical waste management.
- *Aspect 2:* Knowledge regarding the importance and procedures of biomedical waste management.

Scoring and Interpretation for Knowledge Section

Each correct response is awarded 1 mark, and each incorrect or unanswered response is given 0 marks. The total possible score is 30 (Table 2). The scores are interpreted as shown in Table 2:

Practice Checklist

This checklist consists of 15 items to evaluate the actual practices related to biomedical waste management among the participants (Table 3).

Table 2. Scoring and interpretation for knowledge.

Score range	Interpretation
21–25	Excellent
16–20	Good
11–15	Average
6–10	Poor
0–5	Very Poor

Table 3. Scoring and interpretation for practice section.

Score range	Percentage	Interpretation
0–5	≤40%	Good Practice
6–10	41–75%	Average Practice
11–15	>75%	Poor Practice

Participants respond with "Yes" (✓) or "No" (✗) to each item.

- A score of 1 is awarded for every "Yes" response.
- A score of 0 is given for every "No" response.

The total possible score is 15.

Scoring and Interpretation for Practice Section

This two-part tool enables the researcher to systematically assess both the knowledge and practical behavior of participants regarding biomedical waste management. The inclusion of socio-demographic variables allows for correlation and comparison, while the structured scoring system ensures objective and consistent data analysis.

CONTENT VALIDITY OF THE TOOL

Validity refers to the extent to which an instrument accurately measures what it is intended to measure. The prepared tool, along with the objectives and the lecture-cum-demonstration program, was submitted to nine experts for validation. Based on their recommendations and guidance from the research supervisor, necessary corrections were made. The tool's statistical validity coefficient was determined to be 0.99.

Reliability of the Tool

Reliability of a research instrument refers to the extent to which it produces consistent results upon repeated measurements. It reflects the instrument's consistency, accuracy, precision, stability, equivalence, and homogeneity. Pre-testing was conducted to determine the tool's reliability by administering the structured knowledge questionnaire to six participants. The reliability was calculated using the simplified split-half method with Karl Pearson's correlation formula (raw score method). The half-test reliability coefficient ($r_{1/2}$) was 0.99. Using the formula for the Spearman-Brown prophecy formula:

$$r_{xx} = \frac{2r_{1/2}}{1+r_{1/2}}$$

The overall reliability was also found to be 0.99. Since the reliability coefficient exceeds 0.70, the tool was considered reliable and suitable for the study.

Pilot Study

Polit and Hungler defined a pilot study as a small-scale trial conducted in preparation for a larger study. The purpose of the pilot study was to evaluate the effectiveness of the lecture-cum-demonstration

teaching program, assess the feasibility of conducting the main study, and determine appropriate methods for statistical analysis. Permission was obtained from the relevant authorities to conduct the study, and participants were informed about its purpose.

The pre-test was administered using a structured knowledge questionnaire, followed by the lecture-cum-demonstration on the same day. On the 7th day, a post-test was conducted using the same knowledge questionnaire and practice checklist. Participants took approximately 40 min to complete the tools. The overall mean percentage score for the post-test (64%) was higher than the pre-test means score (51.24%), indicating a 64% improvement in knowledge. The difference between pre-test and post-test scores was statistically significant at the 5% level ($P<0.05$). The findings of the pilot study demonstrated that the main study was feasible.

Data Collection and Procedure

1. *Permission from the concerned authority*: Official administrative approval was obtained from the Principal of GIMS Institute of Allied Health Science, Gadag.
2. *Period of Data collection*: The primary data collection for the study was carried out over a period of 1 week at GIMS Institute of Allied Health Science, Gadag.
3. *Pre-test (01):* Data collection involves gathering information from the selected sample units. The investigator conducted a pre-test to assess the knowledge and practices related to biomedical waste management among 54 students at GIMS Institute of Allied Health Science, Gadag. The study's objectives and purposes were explained to the participants, and confidentiality was assured. Consent to participate was obtained, and approximately 40 min were required for data collection.
4. *Administration of exhibition program (X):* The exhibition program on rainbow nutrition was showed after pre-testing on the same day.
5. *Post-test (O2):* The post-test was conducted on the 8th day following the pre-test and the lecture-cum-demonstration teaching program to evaluate its effectiveness in enhancing students' knowledge and practices. Structured knowledge questionnaires and checklists were used for assessment. Each participant took approximately 40 min to complete the post-test. All participants cooperated fully with the investigator during both the pre-test and post-test.

METHOD OF DATA ANALYSIS

The data was analyzed in terms of objectives of the study. The plan for data analysis is as follows:

1. Descriptive statistics; and
2. Inferential statistics.

Descriptive Statistics

1. Frequency and percentage distribution are used to analyze demographic data of students.
2. Mean, percentage and standard deviation are used to assess the level of knowledge of students.

Inferential Statistics

1. Paired "t" test was used to assess the effectiveness of Exhibition program. Chi square test was used to find association between post-test knowledge score and demographic variables.

Ethical Considerations

- The study was approved by Research committee.
- Formal permission was obtained from the Principal of GIMS Institute of Allied health science, Gadag.
- Informed consent was obtained from the study samples.
- The subjects were assured of the anonymity and confidentiality of the information provided by them.

- The subjects were informed that their participation was on voluntary basis and can withdraw from the study at any time.
- No ethical issues arose during the study.

SAMPLE SIZE: ESTIMATION OF POPULATION

Population refers to the entire set of individuals or objects in which the researcher interested in studying. Population in the present study is students of GIMS Institute of Allied health science, Gadag.

Sample Size Estimation

The size and structure of a study should align with the research context, including the research objectives and the type of analyses planned. In this case, the study uses a one-group pre-test post-test design, which typically involves measuring a single group before and after an intervention.

Sample Size Calculation (with Finite Population Correction)

Given:

- Confidence Level (Z) = 95% $\rightarrow Z = 1.96$ (Note: The correct Z-score for 95% confidence is 1.96, not 1.44).
- Margin of Error (E)=5%=0.05.
- Estimated Proportion (p)=0.5 (most conservative estimate).
- Population Size (N)=60.

Step 1: Initial Sample Size (Without Correction for Finite Population)

$$n_0 = \frac{Z^2 \cdot p(1-p)}{E^2}$$

$$n_0 = \frac{(1.96)^2 \cdot 0.5 \cdot (1-0.5)}{(0.05)^2}$$

$$n_0 = \frac{3.8416 \cdot 0.25}{0.0025} = \frac{0.9604}{0.0025} = 384.16$$

Step 2: Apply Finite Population Correction (FPC)

$$n = \frac{n_0}{1+\frac{n_0-1}{N}} = \frac{384.16}{1+\frac{384.16-1}{60}} = \frac{384.16}{1+6.386} = \frac{384.16}{7.386} \approx 52.01$$

Final Estimated Sample Size: Approximately 52 participants

To ensure sufficient power, and accounting for potential attrition or incomplete data, the final sample size was rounded up to 54 participants.

Notes

- The Z-score of 1.44 used earlier was incorrect for 95% confidence; the correct value is 1.96.
- The formula and explanation were clarified to follow standard statistical notation and steps.
- This calculation assumes maximum variability (p=0.5), which yields the largest required sample size, a conservative approach.

Sample and Sampling Technique

As the estimated sample size was 54 and as per the suggestions given by the permitting authority and experts, complete enumeration was done to include all the school students of GIMS Institute of allied health science as study participants.

Sampling Criteria for Selection of Study Participants

Inclusive Criteria

- Both male and female allied health students are included in the study.
- Allied health science students who can read and write English.
- Allied health science students who are present during the time of study.

Exclusive Criteria

- Allied health science students, who have undergone classes on biomedical waste management.
- Allied health science students who are not willing to participate in the study.

Sample Size

After applying inclusion and exclusion criteria, 54 students of GIMS Institute of allied health science, were included in this study as study participants.

RESULTS

The presentation of results forms the core of a research project, as it communicates the facts, measurements, and observations collected by the researcher. To achieve meaningful results, the collected data must be systematically processed and analyzed. Analysis involves organizing and synthesizing the data to answer research questions and test hypotheses. The purpose of this process is to reduce the data into an interpretable format, allowing the relationships within the research problem to be examined and evaluated. In this study, the data collected from 54 respondents were analyzed and interpreted using descriptive and inferential statistics, based on the study's objectives and hypotheses.

Presentation of the Data

1. *Section I*: Analysis of demographic characteristics of respondents under study.
2. *Section II:* Assessment of pre-test and post-test knowledge scores and practice scores of respondents and effectiveness of exhibition program.
   a. Analysis of pre-test knowledge scores and practice scores.
   b. Analysis of post-test knowledge scores and practice scores.
   c. Effectiveness of lecture-cum-demonstration on knowledge and practice regarding biomedical waste management.
3. *Section III:* Analysis of association between demographic variables with post-test Knowledge scores.

Section I: Analysis of Demographic Characteristics of Respondents Under Study

The demographic data of the sample were analyzed in terms of socioeconomic status, age, religion, gender, source of information, and academic branch. The frequency and percentage distributions of respondents based on these demographic characteristics related to biomedical waste management are presented in the following Tables and Figures.

The data presented in Table 4 indicate that 29.6% of the respondents were 20 years old, 59.3% (32 respondents) were 21 years old, and 11.1% (6 respondents) were 22 years old (Figure 3).

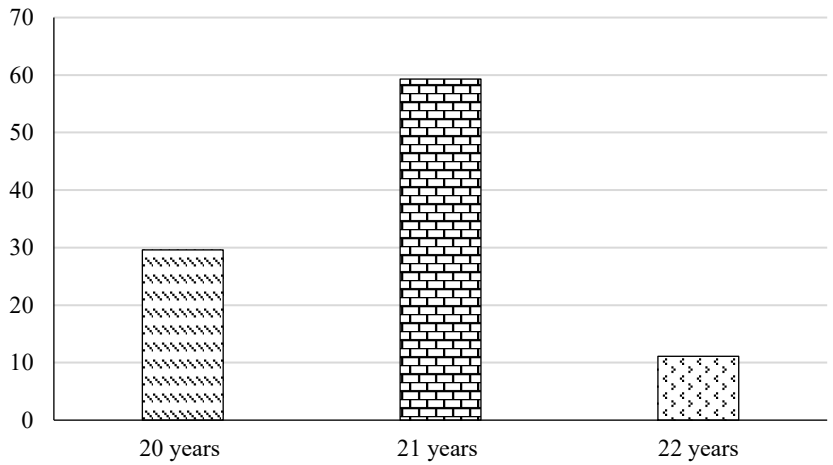

Figure 3. Classification of respondents by age.

Table 4. Classification of respondents by age (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Age Group	20 years	16	29.6
	21 years	32	59.3
	22 years	6	11.1
Total		54	100

Table 5. Classification of respondents by gender (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Gender	Female	36	66.7
	Male	18	33.3
Total		54	100

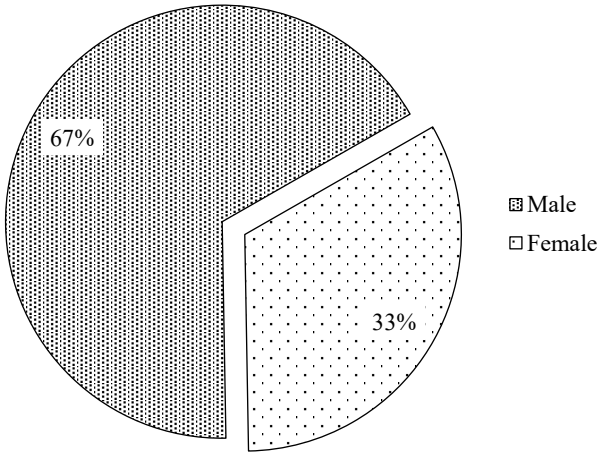

Figure 4. Classification of respondents by gender.

Table 6. Classification of respondents by religion (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Religion	Hindu	43	79.6
	Muslim	8	14.8
	Christian	3	5.6
Total		54	100

The data from Table 5 depicts that majority (66.7% (36)) of the respondents were males and 33.3% (18) respondents were females (Figure 4).

The Data from Table 6 reveals that 79.6% (43) of the respondents belong to Hindu Religion, 14.8% (8) of respondents belong to the Muslim Religion, and 5.6% (3) of the respondents belong to the Christian religion (Figure 5).

The data from Table 7 depicts that 33.3% (18) of respondents had monthly income between Rs. 1000 and 30000, 38.9% (21) of respondents had monthly income between Rs. 30000 and 60000, 12.9% (7) of respondents had monthly income between Rs. 60000 and 90000, 11.1% (6) of respondents had monthly income between Rs. 90000 and 1.2 lakh and remaining 3.8% (2) of respondents had monthly income above Rs. 1.2 lakh (Figure 6).

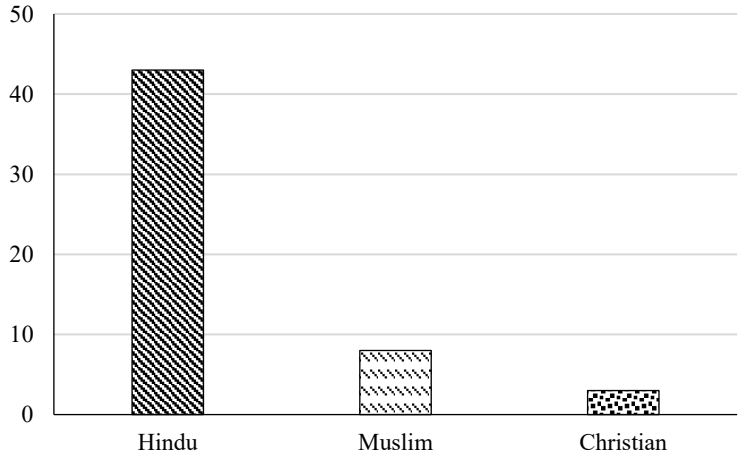

Figure 5. Classification of respondents by religion.

Table 7. Classification of respondents by socioeconomic status (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Socioeconomic Status	Rs. 1000–30000	18	33.3
	Rs. 30000–60000	21	38.9
	Rs. 60000–90000	7	12.9
	Rs. 90000–1.2 Lakh	6	11.1
	>1.2 Lakh	2	3.8
Total		54	100

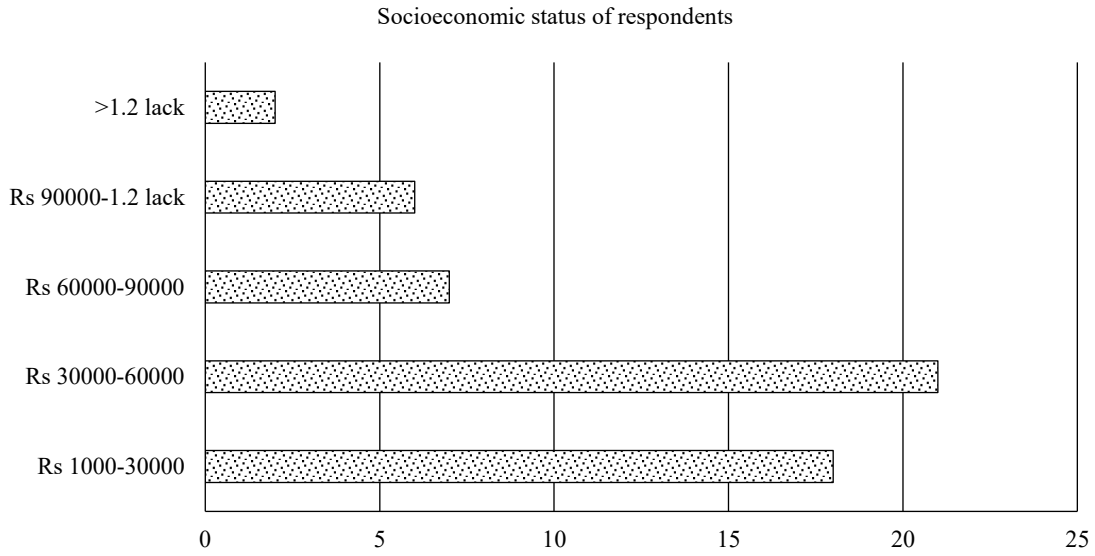

Figure 6. Classification of respondents by socioeconomic status.

The data from Table 8 despites that 33.3% (18) respondents from 2nd year, 40.7% (22) respondents from 3rd year and 26% (14) respondents from 4th year (Figure 7).

The data from Table 9 shows that majority of 55.5% (30) respondents had no information, whereas 18.5% (10) respondents were receiving information from mass media and of 26% (14) respondents were receiving information from syllabus/curriculum (Figure 8).

Table 8. Classification of respondents by year of study (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Year of Study	2nd Year	18	33.3
	3rd Year	22	40.7
	4th Year	14	26.00
Total		54	100

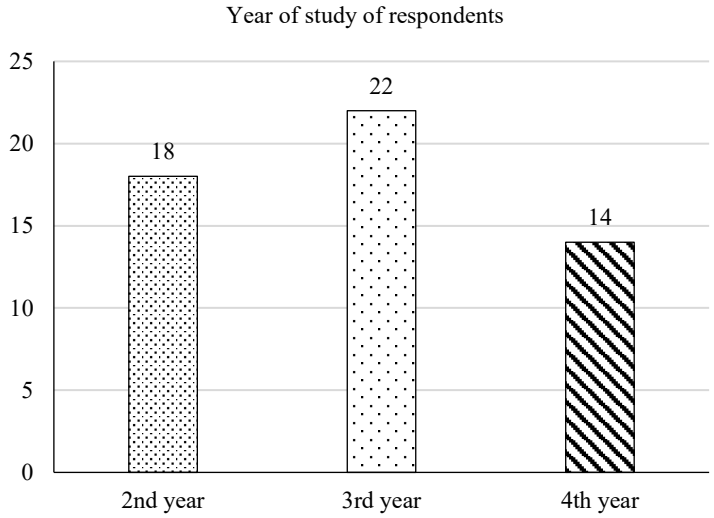

Figure 7. Classification of respondents by year of study.

Table 9. Classification of respondents by source of information (N=54).

Characteristics	Categories	Respondents	
		Number	***Percent***
Source of Information	Syllabus	30	55.5%
	Mass Media	10	18.5%
	No Information	14	26%
Total		54	100

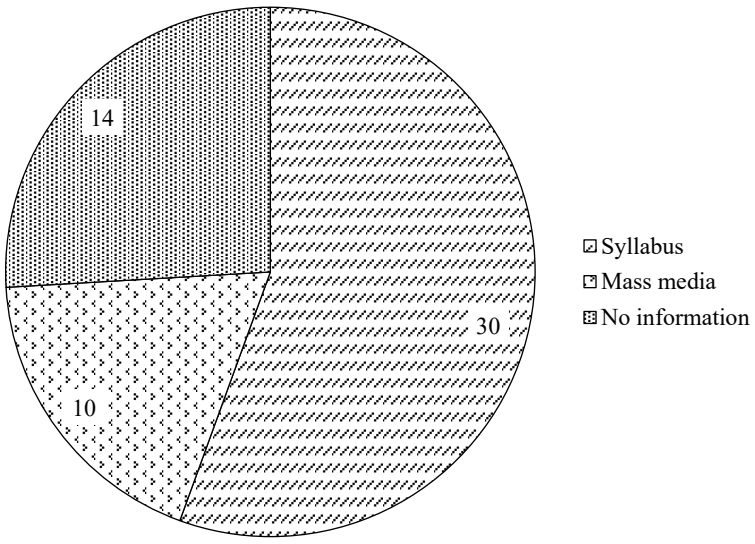

Figure 8. Classification of respondents by source of information.

Table 10. Classification of respondents by branch (N=54).

Characteristics	Categories	Respondents	
		Number	*Percent*
Branch	MIT	14	26.0
	MLT	17	31.5
	OT	13	24.0
	Renal	10	18.5
Total		54	100

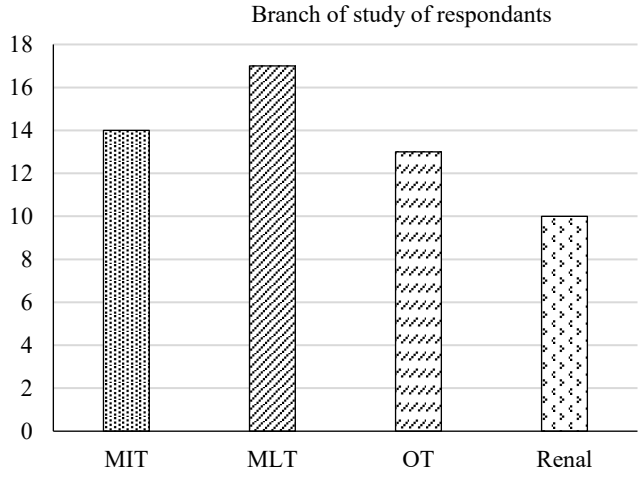

Figure 9. Classification of respondents by branch.

Table 11. Classification of respondents by pre-test score.

Pre-Test	Excellent (21–25)	Good (16–20)	Average (11–15)	Poor (6–10)	Very Poor (0–5)	Total
Number	0	10	35	9	0	54
Percentage (%)	0	18.52%	64.8%	16.7%	0	100%

Table 12. Classification of respondents by post- test score.

Post-Test	Excellent (21–25)	Good (16–20)	Average (10–15)	Poor (6–11)	Very Poor (0–5)	Total
Number	0	30	24	0	0	54
Percentage (%)	0	55.6%	44.4%	0	0	100%

The data from Table 10 reveals that 26% of the respondents belong to the of MIT branch, 31.5% (17) of respondents belong to the MLT branch, 24.0% (13) of respondents belong to the OT branch, and 18.5% (10) of the respondents belong to the Renal branch (Figure 9).

Section 2 Assessment of Pre-Test and Posttest Knowledge Regarding Biomedical Waste Management Among Allied Health Science

The data from Table 11 reveals that, there is no respondent who belongs to the Pretest score Excellent (21–25), and very poor (0–5), 18.52% (10) of the respondents belong to the Pretest score of good (10–15) and 64.8% (35) of the respondents belong to the Pre-test score of average, whereas 16.7% (09) of the respondents belong to the Pre-test score of poor (Figure 10).

The data from Table 12 reveals that, there is no respondent who belongs to the Pretest score Excellent (21–25), poor (6–11) and very poor (0–5), 55.6% (30) of the respondents belong to the Pretest score of good (10–15) and 44.4% (24) of the respondents belong to the Pretest score of average (Figure 11).

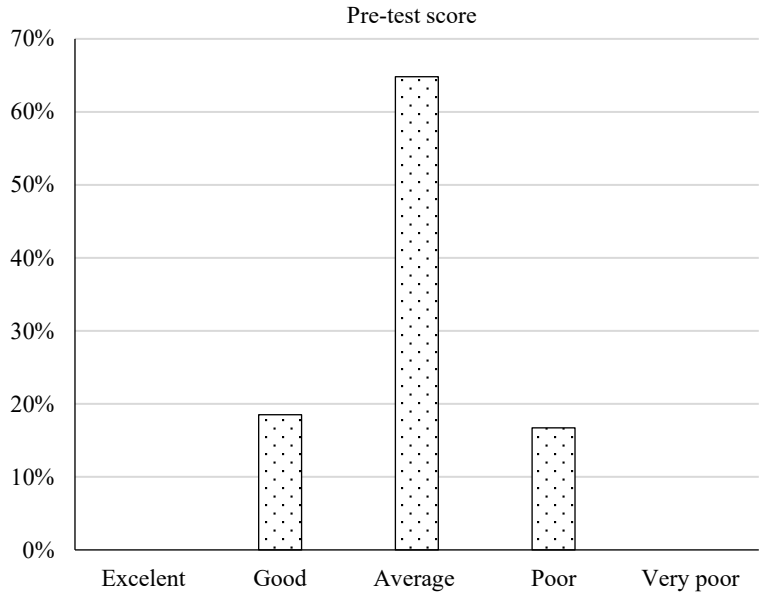

Figure 10. Classification of respondents by pre- test score.

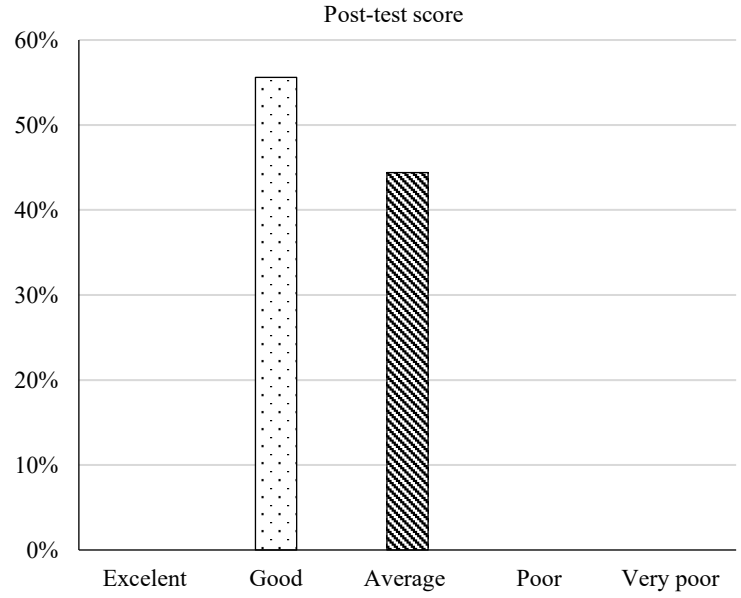

Figure 11. Classification of respondents by post-test score.

Section 2a: Evaluation of the Effectiveness of Lecture Method on Knowledge of Allied Health Students Regarding Biomedical Waste Management

H1: There is a significant difference between pretest and posttest knowledge score, as the calculated value (1.69) is the highest than the Table t value (1.29) for the degree of freedom (53) and 5% level of significance, the hypothesis (H1) is accepted (Table 13).

Finding revealing that there is significant difference between pretest and posttest knowledge score, hence the lecture-cum-demonstration program is proved to be effective.

The data from Table 14 reveals that, there is no respondent who belongs to the Pretest score average (5–10), and poor (01–05); and 100% (54) of the respondents belong to the Pretest score of good (11–15) (Figure 12).

The data from the above Table 15 reveals that, there is no respondent who belongs to the Posttest score average (5–10), and poor (01–05), whereas 100% (54) of the respondents belong to the Pretest score of good (11–15) (Figure 13).

Table 13. Significant difference between the pretest knowledge and post-test knowledge scores of allied health students.

Category	No. of samples	Mean	Mean percentage	Standard deviation	Paired test	Tablet value
Pre-test	54	12.81	51.24%	3.1864934	1.69	1.29
Post-test	54	16	64%	1.98104		
Difference B/N Pre- and Post-test	54	3.19		.		

Table 14. Classification of respondents by pre-test score.

Pre-Test	Good (11–15)	Average (05–10)	Poor (01–05)	Total
Number	54	0	0	54
Percentage (%)	100%	0	0	100%

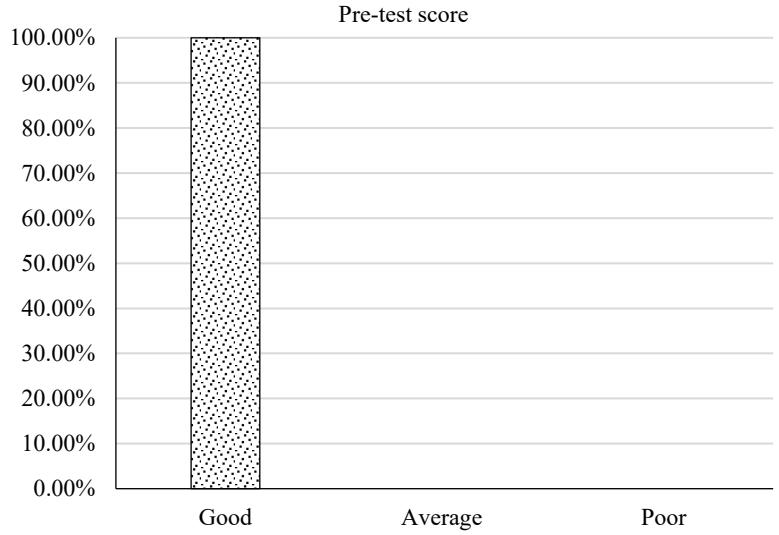

Figure 12. Classification of respondents by pre-test score.

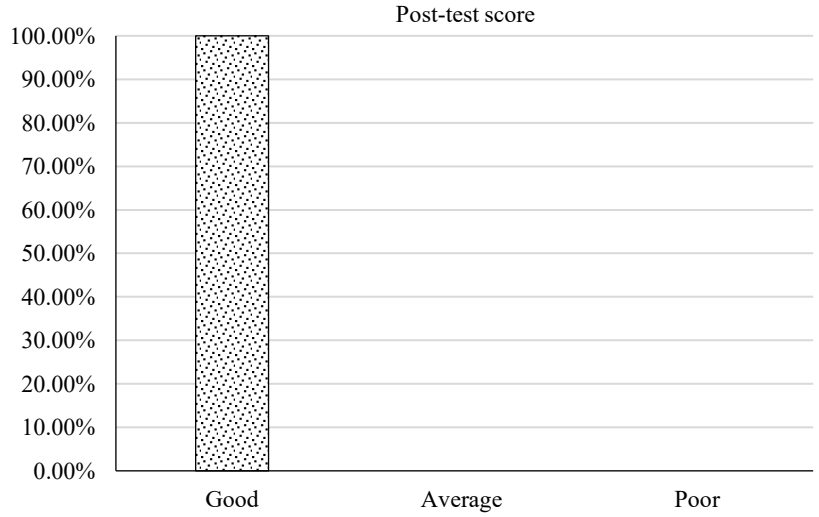

Figure 13. Classification of respondents by post-test score.

Section 2b: Evaluation of the Effectiveness of Lecture-Cum-Demonstration of Practice Regard Biomedical Waste Management

H2: There is a significant difference between pretest and posttest practice score as the calculated value (1.85) is the highest than the table t value (1.29) for the degree of freedom (39) and 5% level of significance, so, the hypothesis (H2) is accepted (Table 16). Finding revealing that there is a significant difference between pre-test and post-lest practice score, hence the lecture-cum-demonstration program is found to be effective.

Section 3 Association Between Post-test Knowledge Scores and Selected Socio-Demographic Variables

H4: The findings indicate a significant association between post-test knowledge on biomedical waste management among allied health science students and their selected demographic variable (source of information). Additionally, there was a significant difference between pre-test and post-test knowledge scores, demonstrating the effectiveness of the lecture-cum-demonstration program (Table 17).

NS: Not Significant and DF: Degree of freedom

Chi-square analysis was performed using a contingency Table to determine the association between students' post-test knowledge scores and their selected socio-demographic variables. The results showed a significant association between post-test knowledge scores and the source of information. However, no significant association was found between post-test knowledge scores and other socio-demographic variables, including economic status, age, religion, gender, and academic branch, in relation to biomedical waste management.

Association Between Post-test Knowledge Scores and Selected Socio-Demographic Variables

Percentage-wise Association Between Post-Test Practice Scores and Selected Demographic Variables

The pre-test and post-test practice scores were identical for all participants, indicating no association between practice scores and the selected demographic variables.

Table 15. Classification of respondents by post-test score.

Post-test	Good (11–15)	Average (05–10)	Poor (01–05)	Total
Number	54	0	0	54
Percentage (%)	100%	0	0	100%

Table 16. Significant difference between the pretest practice and post-test knowledge scores of student.

Category	No. of samples	Mean	Mean percentage	Standard deviation	Paired test	Tablet value
Pre-test	54	13.09	87.26	0.995623	1.85	1.29
Post-test	54	14.09	99.3	0.292582		
Difference B/N Pre and Post-test	54	1		.		

Table 17. Percentage wise Association between post-test knowledge scores and selected demographic variables (N=54).

S.N.	Socio- demographic variables	Df	Chi-square value	Table value	Level of significance	Association
1	Economic status	4	8.2	9.49	0.05	Not significant
2	Religion	2	0.81	5.99	0.05	Not significant
3	Age	2	1.01	5.99	0.05	Not significant
4	Gender	1	0.33	3.84	0.05	Not significant
5	Source of information	2	6.78	5.99	0.05	Significant Association
6	Branch	3	2.02	7.82	0.05	Not significant

NS: Not Significant and DF: Degree of freedom

Chi-square analysis was performed using a contingency table to examine the association between students' post-test practice scores and their selected socio-demographic variables. The results indicated no significant association between post-test practice scores and any of the socio-demographic variables, including economic status, age, religion, gender, source of information, and academic branch, in relation to biomedical waste management. Hence when it comes to practice, H4 is rejected for the socio-demographic variables like: Economic Status, Age, Religion, Gender, Source of information and Branch regarding biomedical waste management.

DISCUSSION

Biomedical waste (BMW) collection and proper disposal have become a substantial issue for both the general and the medical community. In the present-day scenario, approximately 15% of biomedical waste is found to be hazardous and may affect the health of both general community and medical personnel. Medical students as future professionals are soon going to be an integral part of health care system. The biomedical waste management is very crucial process to avoid biohazardous like infection so we want to increase knowledge and practice of the allied students to proper BMW management to avoid infection by giving lecture-cum-demonstration regarding BMW management.

Description of Socio-Demographic Characters of Sample

Section 1: Analysis of Demographic Characteristics of the Respondents

The demographic characteristics of the study sample were analyzed in terms of socioeconomic status, age, religion, gender, source of information, and academic branch concerning biomedical waste management. Frequency and percentage distributions of respondents based on these characteristics are presented in the Figures.

According to Table 1, 29.6% of respondents were 20 years old, 59.3% (32 respondents) were 21 years old, and 11.1% (6 respondents) were 22 years old. Table 2 shows that the majority of respondents were males (66.7%, 36 respondents), while females constituted 33.3% (18 respondents). Table 3 indicates that 79.6% (43 respondents) were Hindus, 14.8% (8 respondents) were Muslims, and 5.6% (3 respondents) were Christians. The data from Table 4 depicts that 33.3% (18) of respondents had monthly income between Rs. 1000 and 30000, 38.9% (21) of respondents had monthly income between Rs. 30000 and 60000, 12.9% (7) of respondents had monthly income between Rs. 60000 and 90000, 11.1%(6) of respondents had monthly income between Rs. 90000 and 1.2 lakh and remaining 3.8% (2) of respondents had monthly income above Rs. 1.2 lakh.

The data from Table 5 shows that 33.3% (18) of the respondents were from 2nd year, 40.7% (22) were from 3rd year, and 25.9% (14) were from 4th year.

The data from Table 6 shows that majority of (55.5%(30)) respondents had no information about the topic, whereas 18.5% (10) respondents were receiving information from mass media and of 26% (14) respondents were receiving information from syllabus/curriculum.

The data from Table 7 reveals that 26% of the respondents belong to the of MIT branch, 31.5% (17) of respondents belong to the MLT branch, 24.0% (13) of respondents belong to the OT branch, and 18.5% (10) of the respondents belong to the Renal branch.

Section 2: Assessment of Pre-Test and Post-Test Knowledge Regarding Biomedical Waste Management Among Allied Health Science

Assessment of Knowledge:

The data from Table 8 reveals that, there is no respondent who belongs to the Pretest score Excellent (21–25), and very poor (0–5), 18.52% (10) of the respondents belong to the Pretest score of good (10–15), 64.8% (35) of the respondents belong to the Pre-test score of average, and 16.7% (09) of the respondents belong to the Pre-test score of poor.

The data from Table 9 reveals that, there is no respondent who belongs to the Post-test score Excellent (21–25), poor (6–11) and very poor (0–5), 55.6% (30) of the respondents belong to the Pretest score of good (10–15) and 44.4% (24) of the respondents belong to the Pre-test score of average.

The data from Table 10 reveals that, hypothesis H1 which states there is a significant difference between pretest and posttest knowledge score; as the calculated value (1.69) is the higher than the table t value (1.29) for the degree of freedom (53) and 5% level of significance, so the hypothesis (H1) is accepted.

The finding reveals that there is a significant difference between pretest and post-lest knowledge score, hence the lecture-cum-demonstration program is proved to be effective.

Assessment of Practice

The data from Table 10 reveals that, there is no respondent who belongs to the Pretest score of practice average (5–10), and poor (01–05), 100% (54) of the respondents belongs to the Pretest score of good (11–15).

The data from Table 12 reveals that, there is no respondent who belongs to the Posttest score average (5–10), and poor (01–05), 100% (54) of the respondents belong to the Pretest score of good (11–15).

The data presented in Table 13 indicates that hypothesis H2, which states that there is a significant difference between pre-test and post-test practice scores, is supported. The calculated t-value (1.85) is greater than the table t-value (1.29) at 39 degrees of freedom and a 5% level of significance, leading to the acceptance of H2.

These findings reveal a significant improvement in practice scores from pre-test to post-test, demonstrating the effectiveness of the lecture-cum-demonstration program.

Section 3: Association Between Post-Test Knowledge Scores and Selected Demographic Variables

The data in Table 14 indicates that hypothesis H4, which states that there is a significant association between post-test knowledge on biomedical waste management among allied health science students and their selected demographic variable (source of information), is supported.

The finding reveals that there is significant difference between pretest and post-lest knowledge score, hence the lecture-cum-demonstration program is proved to be effective.

Association Between Post-Test Practice Scores and Selected Demographic Variables

Here, all the pre-test and posttest practice scores are same, so there is no association between pretest and posttest practice.

CONCLUSION

The aim of this study is to evaluate the effectiveness of a lecture-cum-demonstration in improving knowledge and practices related to biomedical waste (BMW) management among Allied Health students at GIMS, Gadag. Proper collection and disposal of biomedical waste have become critical concerns for both the general public and healthcare professionals. Currently, around 25% of biomedical waste is hazardous, posing potential health risks to both the community and medical personnel. As future healthcare providers, medical students will play a vital role in the healthcare system.

According to the Biomedical Waste (Management and Handling) Rules, 1998, all individuals involved in generating or disposing of biomedical waste are expected to have adequate knowledge, practices, and the ability to guide others in proper collection, handling, and management. Effective biomedical waste management is not only a legal requirement but also a social responsibility. Waste should be segregated at the point of generation into designated containers or bags, with color coding

typically including yellow, red, blue, and black. Treatment and disposal methods for healthcare waste include incineration, chemical disinfection, wet and dry thermal treatment, microwave irradiation, land disposal, and inertization.

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