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A Study to Assess the Effectiveness of Self-Instructional Module on Knowledge of Electrocardiogram Among Staff Nurse in a Selected Hospital in Mahagaon

Shastri Neha M.*, Borkar Aleen, Eppalwar Sunita, Sambaragi S. Vijay

Abstract

Objectives: *This study aimed to evaluate the staff nurses' knowledge of electrocardiograms (ECG) and to determine the impact of a structured teaching program in improving their understanding of the subject.* ***Methodology:*** *An evaluative research design was employed for this study. The study involved 22 staff nurses chosen through simple random sampling and was carried out at Sant Gajanan Maharaj Rural Hospital, Mahagaon. A structured knowledge questionnaire was used to gather data, followed by a structured teaching program. The collected data were analysed using descriptive and inferential statistics in alignment with the study objectives.* ***Results:*** *The demographic analysis revealed that the majority of staff nurses (15%) were aged between 21 and 23 years, with 90% belonging to the Hindu religion, and 70% were females. Additionally, 75% of the participants had prior knowledge of ECG. In the pre-test, most staff nurses had some basic knowledge regarding electrocardiograms. Following the structured teaching program, a notable enhancement in their knowledge was observed. Post-test results showed that 90% of the nurses gained adequate knowledge, while 10% showed moderate knowledge. The mean post-test knowledge score was 13.85, with a standard deviation of 2.37, compared to a mean pre-test score of 6.7, reflecting a significant increase in knowledge with a mean difference of 7.15. The paired t-test result was t=29.3511, p=0.005. The improvement was statistically significant, demonstrating the effectiveness of the structured teaching program in enhancing the participants' knowledge. Additionally, no significant relationship was identified between the pre-test knowledge scores and the demographic variables.* ***Conclusion:*** *The study concluded that the structured teaching program was highly effective in improving the knowledge of staff nurses regarding electrocardiograms. The program successfully increased their understanding and competence in ECG interpretation, emphasizing the importance of such educational interventions in healthcare settings.*

Keywords: Electrocardiogram (ECG), staff nurses, structured teaching program, knowledge assessment, evaluative research design

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INTRODUCTION

The overall mean post-test knowledge score for staff nurses regarding electrocardiograms was 13.85, with a standard deviation of 2.37. In comparison, the mean pre-test knowledge score was 6.7, showing a mean difference of 7.15. The calculated paired t-test value (t=29.3511, p=0.005) was significantly higher than the table value (t=2.093), indicating a notable improvement in knowledge following the structured teaching program [1].

Regarding the association between pre-test knowledge scores and selected demographic

variables, the results showed no significant relationship between the pre-test scores and the demographic factors considered (Figure 1).

ECG WAVE FORM

An electrocardiogram (ECG) records the electrical activity of the heart, displaying a series of waves characterized by peaks and valleys. It provides two key pieces of information: First, it gauges the length of time electrical waves travel through the heart, assisting in determining if the electrical activity is normal, slow, or irregular. Second, it evaluates the level of electrical activity passing through the heart muscle, which can indicate if specific areas of the heart are enlarged or under stress.

The ECG signal has a frequency range between 0.05 and 100 Hz, with a dynamic range of 1–10 mV. The ECG waveform consists of five primary peaks and valleys labeled P, Q, R, S, and T, with the occasional presence of a U wave. The accurate and reliable analysis of an ECG depends on detecting the QRS complex, along with the T- and P-waves. An ideal ECG waveform is illustrated in Figure 2 [2].

The P-wave represents the activation of the two upper chambers of the heart, known as the atria, on an ECG and typically lasts between 0.08 to 0.12 seconds. The QRS complex and T-wave correspond to the electrical activity of the ventricles, also within the same time range of 0.08 to 0.12 sec.

Detecting the QRS complex is a crucial aspect of automated ECG analysis. Once the QRS complex is identified, the full ECG signal is analysed to assess the P, QRS, and T-waves, which reflect the rhythmic electrical depolarization and repolarization of the heart muscle, tied to the contraction of the atria and ventricles [3].

The baseline or isopotential line is the horizontal section of the waveform that appears before the P-wave. The P-wave itself signifies the depolarization of the atrial muscle. The QRS complex represents the combined electrical activity of atrial repolarization and ventricular depolarization, which occur almost simultaneously. The T-wave indicates ventricular repolarization, while the U-wave, if present, is thought to reflect afterpotentials in the ventricular muscle [4].

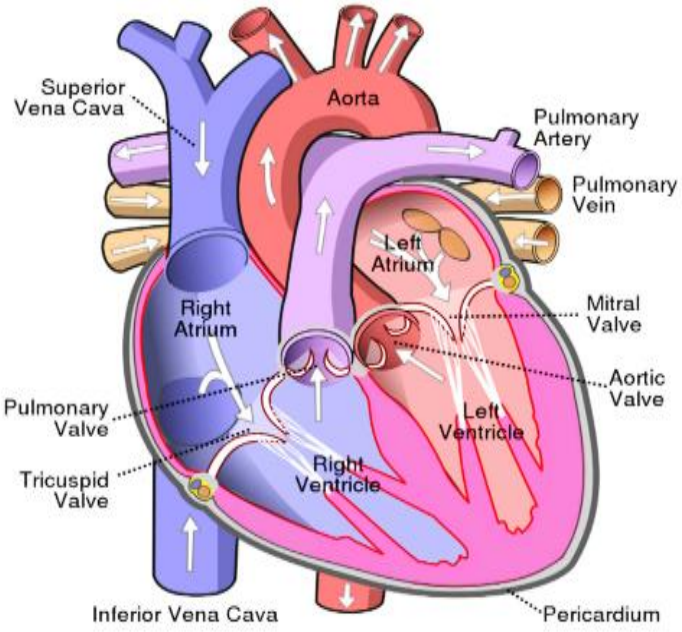

Figure 1. Schematic anatomy of the human heart.

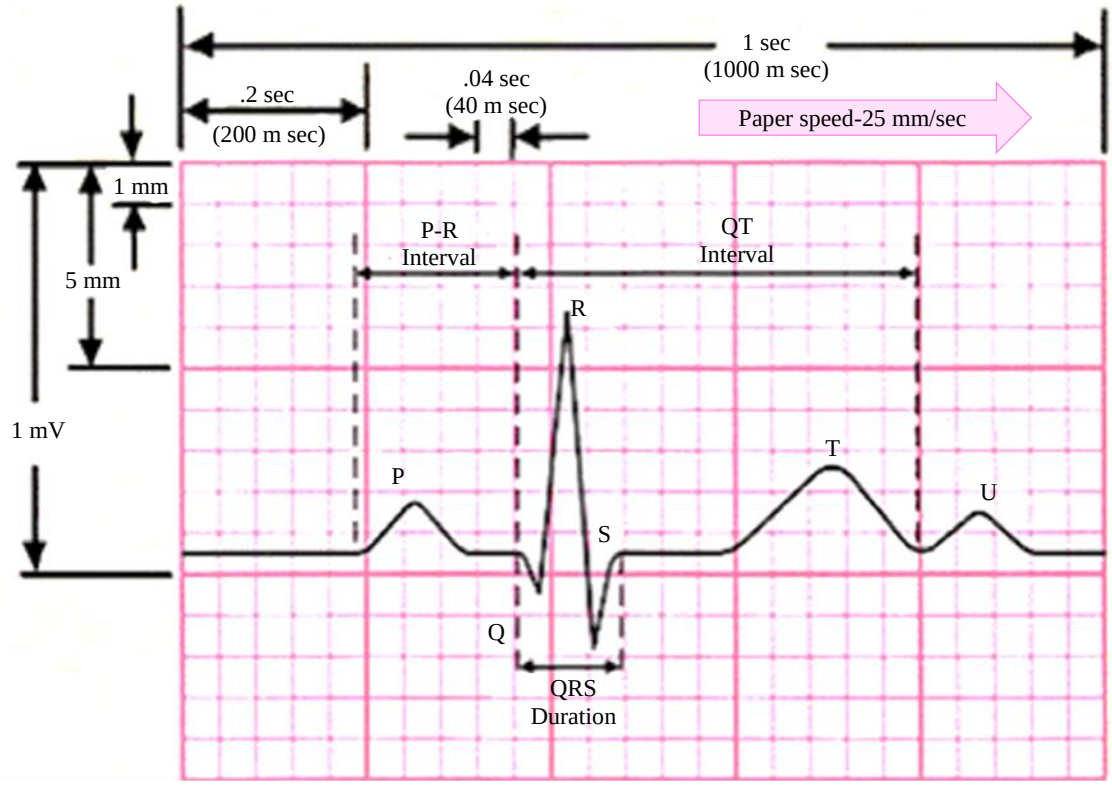

Figure 2. An ideal ECG waveform.

Table 1. ECG patterns.

ECG Reading Abnormality	Characteristics
Bradycardia	R-R interval>1 s
Tachycardia	R-R interval<0.6 s
Hypercalcemia	QRS interval<0.1 s
Dextrocardia	Inverted P and T-wave
Hyperkalaemia	Tall T-wave and absence of P-wave
Sudden cardiac death	Plane ECG
Sinoatrial block	Complete drop out of a cardiac cycle
Myocardial ischemia	Inverted T-wave

The duration, amplitude, and shape of the QRS complex are essential for diagnosing conditions like cardiac arrhythmias, conduction problems, ventricular hypertrophy, myocardial infarction, and other heart-related disorders. A normal heart rate typically falls between 60 and 100 beats/min. A heart rate slower than this is called bradycardia (slow heart rate), and a faster rate is referred to as tachycardia (rapid heart rate). Any irregularities in the ECG signal can indicate the presence of arrhythmias. The waveform of normal ECG waveform is shown in Figure 3 and that of the abnormalities is shown in Figures 4 and 5 [2].

Various characteristics of the patterns of ECG wave are listed and the related disease to each pattern are also given in Table 1.

NEED FOR STUDY

Electrocardiography (ECG) is one of the most widely used diagnostic tools in cardiology. When properly interpreted, it is vital in diagnosing and managing patients with heart conditions. It is especially essential for diagnosing cardiac arrhythmias and acute myocardial ischemia, which are responsible for

the majority of heart-related emergencies. ECG is also frequently utilized as a screening test in various clinical situations. However, mastering the basics of ECG interpretation can be challenging, as it requires a solid understanding of the underlying principles [5].

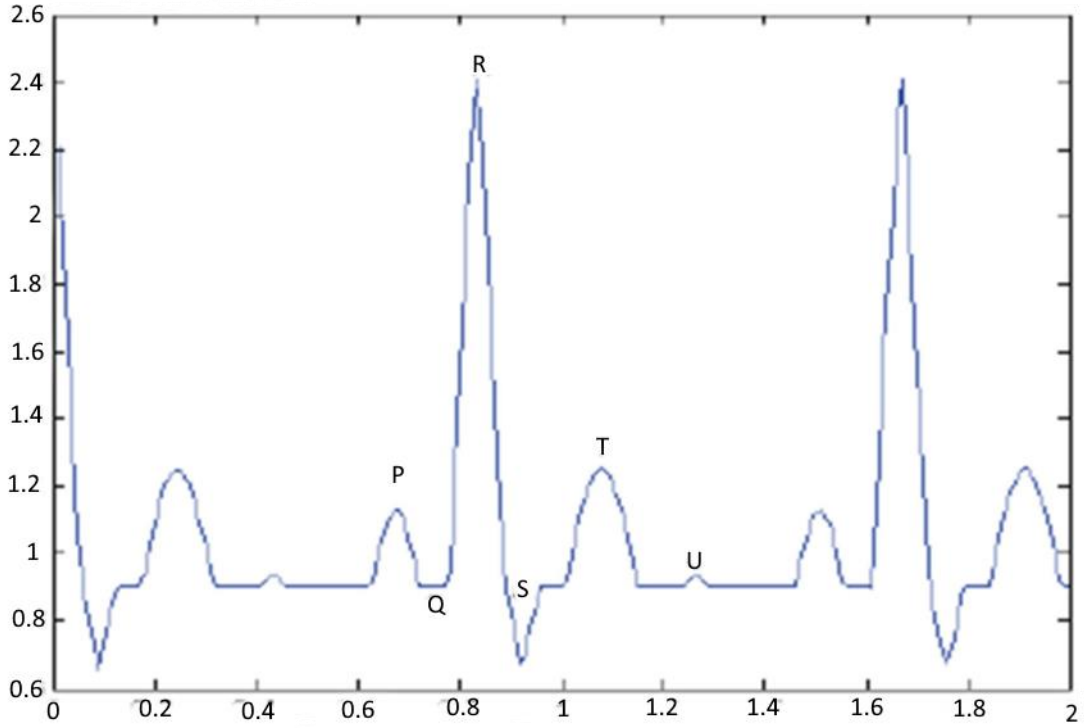

Figure 3. Normal sinus rhythm.

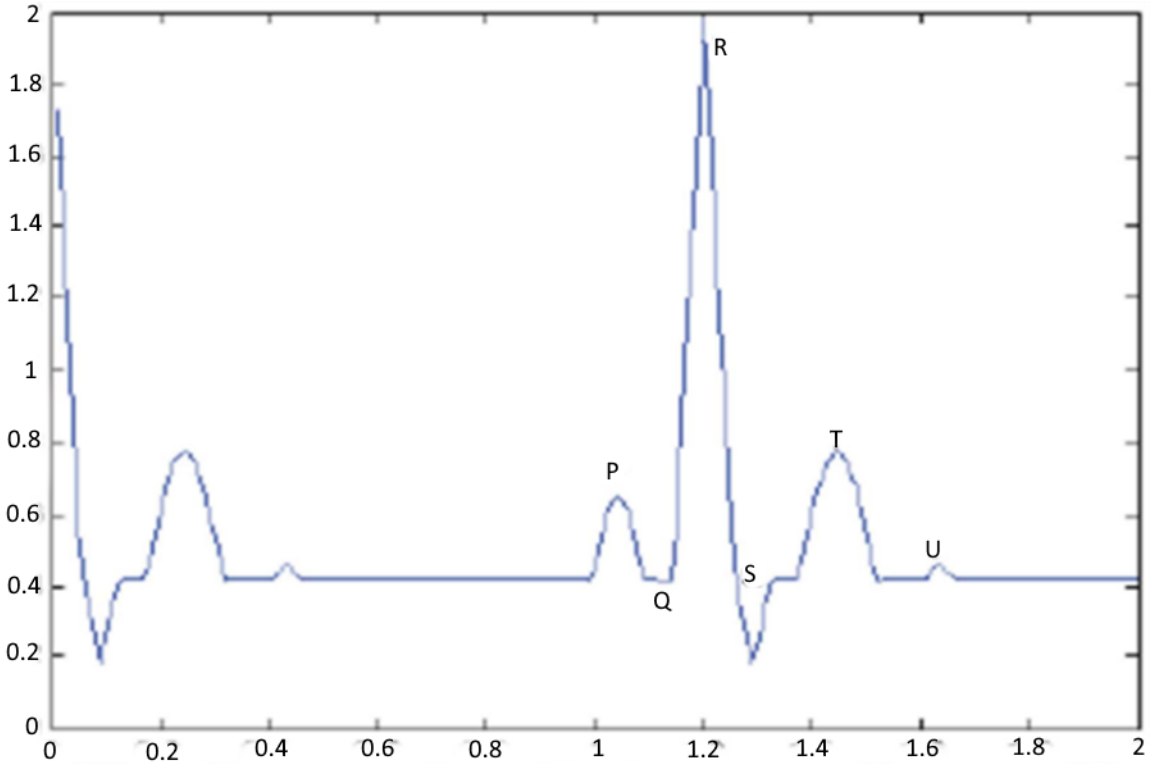

Figure 4. Sinus bradycardia.

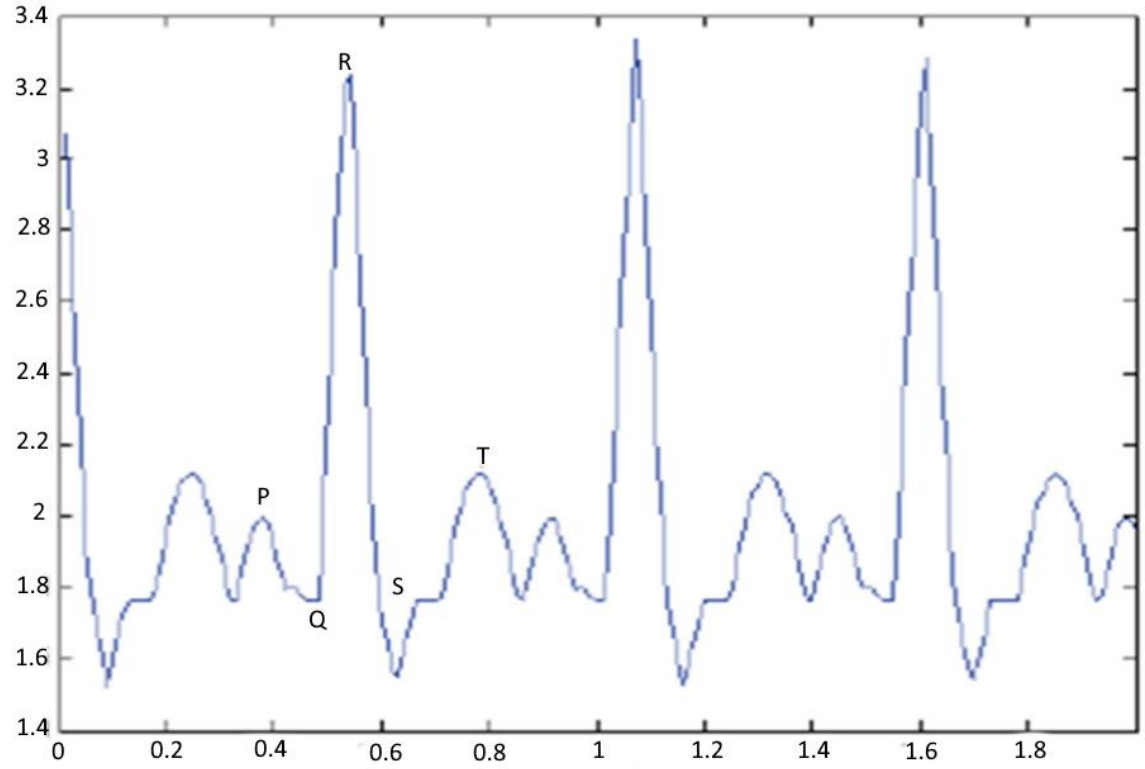

Figure 5. Sinus Tachycardia.

The ECG records the electrical impulses that travel through the heart muscle during its contraction and relaxation. These signals are then converted into line tracings on paper. This fast and non-invasive test can identify whether the heart is beating too rapidly or too slowly. Proper interpretation of an ECG can greatly impact clinical decisions, allowing for early identification and treatment of cardiac emergencies [6].

With advancements in technology and increasing demands on healthcare services, especially in critical care, the severity of patient conditions is rising. Consequently, it is vital for nurses to enhance their knowledge and skills, particularly in cardiac rhythm monitoring, to effectively assess changes in a patient's cardiac status, evaluate treatment responses, and monitor post-surgical recovery. All healthcare professionals, including nursing students and resident doctors, must recognize the importance of correlating clinical findings with ECG results. A solid foundation in ECG interpretation is key to integrating clinical expertise with accurate diagnostic insights [7].

An ECG can also be instrumental in diagnosing various heart conditions, such as abnormal heart rhythms and coronary artery disease. The knowledge regarding ECG interpretation is crucial for the student nurses because of the helping to diagnose, follow up and detect any abnormalities in a patient condition; and therefore they need to know how to interpret them. They overlook the skill of obtaining a 12-lead ECG during their essential hospital orientation, which can help identify a fast heart rate (tachycardia) and detect irregular heartbeats (arrhythmias). An arrhythmia may occur when any part of the heart's electrical system does not work properly [3, 8].

ECG test results play a crucial role in helping healthcare teams diagnose conditions such as irregular heartbeats, known as arrhythmias. An ECG monitors the heart's electrical impulses, offering insights into the heart rate, rhythm (whether regular or irregular), and the timing of electrical signals as they move through the heart's chambers. Variations in ECG readings can signal a range of heart-related problems [9].

The ECG is also valuable in assessing the mechanical activity of the heart, including its contraction and relaxation. This emphasizes the need to train staff nurses in ECG interpretation. Nurses should be able to identify ECG changes that occur with conditions like acute coronary syndrome (ACS) and understand the relationship between ECG readings and coronary circulation or myocardial function. For instance, patients with symptoms consistent with ACS who exhibit high-risk features, such as persistent or dynamic ST-segment changes, require immediate attention. These high-risk features include ST-segment depression of ≥0.5 mm or new T-wave inversion of ≥2.0 mm in more than two contiguous leads [10].

Accurate interpretation of ECGs is crucial, as it can significantly impact clinical decisions, enabling the early detection and rapid treatment of cardiac emergencies. Nurses, especially those working in cardiac care units, need to be well-versed in ECG interpretation. Failure to recognize abnormalities could delay notification to physicians, negatively affecting patient care. Nurses trained in ECG reading are better equipped to identify acute or potential complications early, improving patient outcomes and enhancing care in the cardiac unit. Heart diseases are the primary cause of death globally, taking millions of lives each year. The World Health Organization (WHO) forecasted that by 2020, coronary heart disease would account for 2.6 million deaths in India alone, and this prediction has already passed [11]:

- 90% are males;
- 60% are smokers;
- 14% suffer from hypertension; and
- 8% have diabetes.

According to the Indian Heart Association, 50% of heart attacks in India occur in individuals under the age of 50 years. Furthermore, 40% of young people who experience heart attacks have a history of tobacco use, and 25% of all heart attacks in India occur in individuals under the age of 40 years.

The number of heart attacks in India has fluctuated in recent years [12]:

- 2018: 8,601;
- 2019: 5,849;
- 2020: 5,633; and in
- 2021: 17,880.

Accurate interpretation of ECG readings can play a vital role in clinical decision-making, enabling quick identification and treatment of cardiac emergencies. Nurses, especially those working in cardiac care units, need to be proficient in ECG interpretation. Failing to detect abnormalities may result in delayed notification to physicians, ultimately affecting patient care. Nurses trained to read ECGs can significantly improve patient outcomes by identifying acute or potential complications early, which enhances the efficiency of patient care and promotes timely interventions [13].

ECGs are essential for the early detection of health issues and can integrate real-time data from tests and monitoring devices. This information can then be relayed to doctors and medical staff, improving the overall efficiency and responsiveness of the healthcare system.

Furthermore, smoking significantly contributes to heart disease by raising triglyceride levels, lowering "good" cholesterol (HDL), and making the blood more prone to clotting, which can obstruct blood flow to the heart and brain [14].

Nurses, who are often the first to conduct ECGs, must be able to interpret these readings accurately to evaluate heart function, especially in patients with cardiac diseases or injuries. Additionally, understanding the effects of medication, such as anti-dysrhythmia drugs, is critical in assessing patient responses and adjusting treatment protocols accordingly [15].

Correct ECG interpretation can have a major impact on clinical decisions, enabling quick identification and treatment of cardiac emergencies. It also highlights the importance of enhancing nurses' knowledge and practice of ECG interpretation in the cardiac care unit. The importance of studying ECG arises from the fact that failing to identify abnormalities can lead to delayed notifications to physicians, ultimately affecting patient care. Nurses who are trained in ECG interpretation can enhance patient care by identifying acute or potential complications early, thus improving the overall management of patient conditions [16–20].

Cardiovascular diseases (CVDs) contribute significantly to global health issues, accounting for 40.8 million disability-adjusted life years (DALYs) annually. Of these, 36.4 million years are lost due to premature death (representing 89% of total CVD DALYs), while 4.5 million years are attributed to living with disabilities (YLDs). Major risk factors for heart disease and stroke include high blood pressure, elevated low-density lipoprotein (LDL) cholesterol, diabetes, smoking and exposure to second-hand smoke, obesity, poor diet, and lack of physical activity [21].

OBJECTIVES

1. To evaluate the level of knowledge regarding electrocardiograms (ECGs) among staff nurses at Sant Gajanan Maharaj Rural Hospital, Mahagaon.
2. To evaluate the impact of a structured teaching program on enhancing ECG knowledge among staff nurses at Sant Gajanan Maharaj Rural Hospital, Mahagaon.
3. To explore the correlation between pre-test knowledge scores and specific demographic variables.
4. To investigate the connection between post-test knowledge scores and selected demographic variables.
5. To assess the difference between pre-test and post-test knowledge scores.

HYPOTHESIS

- *H:* The average post-test knowledge score of participants who underwent the structured teaching program will be significantly higher than their average pre-test knowledge scores.

OPERATIONAL DEFINITIONS

Assess

In the present study ‘assess’ refers to the organized systematic and continuous process, gathering information on knowledge of Electrocardiogram from staff nurses of Sant Gajanan Maharaj Rural Hospital, Mahagaon.

Effectiveness

In this study effectiveness means “Improving the knowledge regarding Electrocardiogram for staff nurses of Sant Gajanan Maharaj Rural, Hospital Mahagaon by structured teaching programme which may result differences between pre and post-test knowledge score.”

Structured Teaching Programme

In the present study, it refers to systematically planed teaching programme designed to provide information regarding electrocardiogram among staff nurses of Sant Gajanan Maharaj Rural Hospital, Mahagaon.

Knowledge

It refers to the capacity of the staff nurses at Sant Gajanan Maharaj Rural Hospital, Mahagaon, to provide accurate answers to the questions posed, as assessed through a structured knowledge questionnaire.

ASSUMPTION

1. It is anticipated that the staff nurses' knowledge of Electrocardiogram (ECG) will improve after participating in the structured teaching program.

2. It is assumed that factors such as education level and sources of information influence the staff nurses' knowledge.

Delimitations of the Study

The study is restricted to:

1. Staff nurses working at Sant Gajanan Maharaj Rural Hospital, Mahagaon. A study duration is of only 4 weeks.
2. A sample size is limited to 20 participants.

Conceptual Frame Work

The conceptual framework serves as a set of ideas within a broader theoretical context, helping guide the development of nursing as a profession. Good research integrates findings into a coherent system, linking new knowledge with existing theories through a review of prior studies and identifying an appropriate conceptual framework. This framework offers guidelines for achieving the study's objectives grounded in theory, outlining the scientific steps, activities, and results of the study. The current study focuses on developing and evaluating the effectiveness of a structured teaching program to enhance staff nurses' knowledge of Electrocardiogram (ECG) [22].

The conceptual framework for this study is based on Ludwig von Bertalanffy's General System Theory, which posits that a system consists of interacting components working towards a common goal. Systems include input, throughput, and output. In this study, the framework is applied as follows:

- *Input:* The assessment of staff nurses' knowledge about Electrocardiogram (ECG).
- *Throughput:* The process of improving knowledge and understanding of ECG through the structured teaching program. This includes educating staff nurses on ECG's general information, purpose, importance, and uses.
- *Output:* The measurable increase in knowledge about ECG among staff nurses, assessed through a post-test after the program.
- *Feedback:* The response from the environment, which may be positive, negative, or neutral. Feedback in this study strengthens the input and throughput, as the assessment of nurses' initial knowledge (input) and the teaching process (throughput) are informed by the outcomes (output) of the post-test.

REVIEW OF LITERATURE

"Hardships often prepare people for an extraordinary destiny."

—C.S. Lewis

It refers to an essential element of any research or study, helping to deepen understanding and provide a clear perspective on the problem being investigated. A literature review highlights prior studies and reports relevant to the research topic. It serves as both a process and a product: as a process, it involves gathering and reviewing information on the topic to become familiar with existing research, while also identifying gaps and unresolved issues in the current body of knowledge [7].

Literature Related to General Information on Electrocardiogram

An electrocardiogram (ECG) is a diagnostic test that records the heart's electrical activity. The process is quick and painless. Electrical impulses from the heart cause the heart muscles to contract, resulting in the pumping action of the heart. The ECG records this activity in the form of waves, consisting of spikes and dips. These wave patterns are used to assess the heart's rate and rhythm. The heart naturally generates electrical impulses, which create an electrical current that spreads through the body and reaches the skin. During the test, the patient is connected to an ECG machine using three electrodes: one on each wrist and the third on the left ankle. This standard configuration is used to monitor the heart's activity [8].

A descriptive study was conducted by Tomar *et al.* in 2020 to evaluate the effectiveness of assisted self-directed learning on staff nurses' knowledge of basic electrocardiogram (ECG) and the interpretation of myocardial infarction (MI) [9].

- *Population:* The study was carried out among staff nurses in a selected hospital in Delhi.
- *Sample Size:* A total of 60 nurses were included in the sample.
- *Sampling Technique:* Participants were selected using purposive sampling.
- *Introduction:* Accurate ECG analysis is crucial for nurses, as it helps in the early identification and treatment of myocardial infarction (MI).
- *Methods:* The study was carried out at a selected hospital in Delhi, utilizing a one-group pre-test post-test design to evaluate the effectiveness of the learning intervention for staff nurses.

A total of 60 registered nurses from the cardiology department, including ICU and wards, were selected using purposive sampling. The ASDL session was conducted for 1 h, and the post-test was administered 1 week later. The analysis indicated a statistically significant increase ($p=0.05$) in the post-test scores of the staff nurses. The findings demonstrated that the ASDL effectively enhanced the knowledge of staff nurses regarding basic ECG and the interpretation of myocardial infarction (MI) [9].

A descriptive study by Serhani *et al*., published in Sensors (Basel) in 2020, reviewed ECG monitoring systems, exploring their architecture, processes, and key challenges. Health monitoring and related technologies are an emerging and attractive research area, with the electrocardiogram (ECG) being a widely used tool for assessing and diagnosing cardiovascular diseases (CVDs) [10]. The number of ECG monitoring systems in the literature has been rapidly increasing, which makes it more challenging for researchers and healthcare professionals to choose, compare, and assess systems that align with their specific needs and monitoring demands. This study offers evidence-based insights into the components, contexts, features, and challenges associated with ECG monitoring systems. It proposes a generic architectural model for these systems and offers an in-depth analysis of their value chain. The paper also presents a comprehensive review of relevant literature, categorized according to expert taxonomy, and highlights current challenges and trends. Ultimately, the study highlights the significance of smart monitoring systems that integrate advanced technologies such as deep learning and artificial intelligence (AI) [10].

A descriptive study was done by Lenarduzzi *et al*. on electrocardiographic and echocardiographic profiles of heart failure patients [11]. Setting: Das Hospital. Sample size: 81 patients. Population: patients from Das Hospital. The study focuses on describing and analysing the electrocardiographic and echocardiographic profiles of individuals with heart failure (HF). Methods: This study is a documentary, retrospective, quantitative, and descriptive research, with data collected from patients diagnosed with heart failure (HF) at the Hospital das clinics in Uberlândia. Results: A total of 81 patients took part in the study, with an average age of 66.75 years, 4 to 6 years of formal education, and a family income around two minimum wages. The duration of diagnosis ranged from 5 to 6 years, and the Left Ventricular Ejection Fraction (LVEF) was 40.88±11.97%. The clinical profile revealed a high prevalence of comorbidities, including systemic hypertension, arterial disease, and cardiac arrhythmias, affecting 82.72, 30.86, and 35.80% of patients, respectively [11].

A descriptive study was done by Stanojević *et al*., 'Srp Arh Celok Lek: Electrocardiographic changes in patients with chronic anaemia in November–December 1998' [12]. Sample size: 60. Sample technique: simple random sample technique. It is well-established in the literature that cardiac symptoms such as dyspnoea, palpitations, and occasionally angina can occur in individuals with anaemia. The occurrence of electrocardiographic abnormalities varies widely across studies, ranging from 10 to 80%. This study aims to assess the incidence of specific electrocardiographic changes in both anaemic patients and a control group of non-anaemic individuals before and after a stress test. The study included 60 patients, who were divided into two groups. Group 1 consisted of 30 anaemic patients, all free from cardiorespiratory diseases and with normal chest X-ray findings. The control group

included 30 healthy individuals who had normal chest X-rays, normal ECG at rest, and no anaemia or iron deficiency. ECG findings showed ST segment depression at rest in one patient (3%) from the anaemic group, while no such changes were observed in the control group. The increased R-wave amplitude was significantly more frequent and statistically higher in the anaemic group (30 vs. 3%). The study concludes that the prevalence of ECG abnormalities in anaemic patients was 63%. The electrocardiographic changes observed may not only be indicative of heart disease but could also be related to anaemia, potentially reflecting myocardial ischemia [12].

RESEARCH METHODOLOGY

Research methodology is an organized method for tackling a research problem. It encompasses the principles and concepts that guide researchers in designing their procedures and strategies.

Methodology is an essential part of any research study, offering a framework for systematically moving from the initial identification of the problem to its ultimate solution [19, 23].

This work is organized under the following headings: research approach, research design, study setting, population, sample and sampling techniques, tool development and description, teaching plan development, pilot study, data collection procedure, and data analysis [19].

Research Approach

The research approach refers to the overall plan or blueprint selected to conduct the study. Choosing the appropriate research approach is a fundamental step in carrying out a research inquiry. Evaluative research, a type of applied research, focuses on assessing the effectiveness of a program, practice, procedure, or policy [24].

Research Design

The research design refers to the structured plan or framework for conducting a specific investigation. Research design is the comprehensive plan devised to obtain solutions to the research problem (Table 2). A pre-experimental design was employed for the study, utilizing a single-group pre-test and post-test approach.

Key

- *O1:* Pre-test knowledge score before structured teaching programme.
  X: Treatment variable (Structured teaching programme).
- *O2:* Post-test knowledge after 2 days of administering structured teaching programme.

Settings

Settings will be conducted in Sant Gajanan Rural Hospital, Mahagaon.

Variables

Variables are concepts that can assume different quantitative values. Variables are the measurable characteristics of a concept of logical of attributes. Variables for the present study were:

Independent Variable

The independent variable is the suspected cause of the effects observed in the dependent variables. In the current study, the independent variable was the structured teaching program on electrocardiogram.

Table 2. Systematic representation of pre-experimental design.

	Pre-test	Treatment	Post-test
One group	Day-1, 01	X	Day-3, 02

Dependent Variable

The dependent variable is what the researcher seeks to understand, explain, or predict. In this study, the dependent variable was the staff nurses' level of knowledge regarding electrocardiograms.

Population

The target population of the present study was staff nurses of selected hospital in Mahagaon.

Sample

A sample is a subset of the population selected to participate in a particular study. Sample for the present study was staff nurses working in Sant Gajanan Maharaj Rural Hospital, Mahagaon.

Sample Size

Sample size refers to the number of units selected for inclusion in the study. The sample consists of 20 staff nurses from Sant Gajanan Maharaj Rural Hospital, Mahagaon, who met the inclusion criteria and were working between September and October 2022 at the hospital.

Sampling Technique

Sampling technique refers to the specific process or method used to select the entities for the sample. In this study, the sampling technique used was simple random sampling, a form of probability sampling.

Criteria for Sample Selection

Inclusion Criteria

- Staff nurses who were available during the data collection period.
- Staff nurses who are able to read and understand English.
- Staff nurses who have completed ANM, GNM, B.Sc. Nursing, or PB B.Sc. degrees.

Exclusion Criteria

- Staff nurses who choose not to participate.
- Staff nurses who are unable to read or comprehend English.

Development and Description of Tool

After revising the tool according to the experts' recommendations, the final version includes two sections.

- *Section 1:* Demographic data includes selected demographic variables such as the staff nurses' age, education, experience, and any additional courses completed.
- *Section 2:* It was a self-designed knowledge questionnaire, and had 20 questions.
- *Section 3:* The development of a structured teaching program on electrocardiogram includes a lesson plan, which outlines the goals to be achieved and the specific activities to be carried out during the 30-min session.

The tool was translated into the regional language, and medical terminology was converted into English to match the comprehension level of the samples.

Validity of the Tool

The content validity of the instrument was assessed by obtaining feedback from seven experts in medical-surgical nursing and medical officers. The experts' suggestions were integrated into the tool, which was then modified and finalized.

Pilot Study

A pilot study is a scaled-down version or trial run of the main study, carried out to fine-tune the methodology. After receiving formal permission from the medical officer at Sant Gajanan Maharaj Rural Hospital, Mahagaon, the pilot study was carried out from 25/09/2022 to 28/09/2022. Nursing

staff were chosen using simple random sampling, and those who fulfilled the sampling criteria were included. A structured pre-test and post-test questionnaire was used to gather data from the staff nurses during the pilot study. The gathered data were analysed and interpreted in preparation for the main study. As no changes were required after the pilot study, the researcher proceeded with the final study.

Reliability

The reliability of the tool was assessed using the split-half method, and the reliability coefficient (r=0.92) was found to be substantial.

Data Collection Procedure

The main study was carried out from 25/09/2022 to 08/10/2022, following permission obtained from the medical officer at Sant Gajanan Maharaj Rural Hospital, Mahagaon.

The steps used for data collection wear as follows:

1. The investigators introduced themselves and explained the purpose of the study.
2. The investigators scheduled fixed days for conducting the study.
3. Written consent was obtained from all staff nurses at Sant Gajanan Maharaj Rural Hospital, Mahagaon, to confirm their willingness to participate in the study.
4. The pre-test was carried out.
5. The structured teaching program took place the day following the pre-test.
6. The post-test was administered using the same tool on the third day after the pre-test.
7. The collected data was organized and analysed.

Plan for Data Analysis

The development of the data analysis plan was guided by experts in nursing and statistics, and it was as follows:

1. Organizing the data on a master sheet.
2. The data were organized into tables showing frequency, percentage, mean, standard deviation, and range to describe the data.
3. Classification of knowledge by using the following formula:
   Obtained score: maximum score X=100%; poor 0–30%; average 31–65%; good 66–100%

ANALYSIS AND INTERPRETATION OF DATA

Analysis involves organizing and synthesizing data to enable the answering of research questions and the testing of hypotheses.

This study focuses on the analysis and interpretation of data collected to evaluate the structured teaching program on knowledge about electrocardiograms among staff nurses at a selected hospital in Mahagaon [25–28].

The purpose of this analysis is to condense the data into a manageable format, enabling interpretation and facilitating the study and testing of the research problem. The analysis and interpretation of the data in this study are derived from information gathered through a structured teaching program on knowledge about electrocardiograms among staff nurses at a selected hospital in Mahagaon. The collected data were coded, organized, tabulated, analysed, and interpreted using descriptive and inferential statistics in alignment with the study's objectives and hypotheses.

Table 3 shows the percentage and frequency of staff nurses of Sant Gajanan Maharaj Rural Hospital, Mahagaon according to their demographic variable (Figures 6–10).

- Age of the staff nurses: majority 21–23 years 3 (15%); and minimum above 30 years 4 (20%).
- Sex of staff nurses shows majority 6 (30%) of Male and minimum 14 (70%) of Female.
- Educational qualification of staff nurses shows that majority 5 (25%) of ANM and minimum 5 (25%) of PB B.Sc.

- Religion of staff nurses shows majority 18 (90%) belong to Hindu and minimum 1 (5%) of Muslim.
- Hospital Departments shows majority 1 (5%) of NICU, and minimum 6 (30%) of ward.
- Previous Knowledge: The majority of subject 15 (75%) nurses having previous knowledge and minimum 5 (25%) subjects not previous knowledge.

To Assess the Level of Knowledge on Electrocardiogram Among Staff Nurses by Conducting Pre-test and Post-test

It is observed in Table 4 that pre-test knowledge score of electrocardiogram among staff nurses was poor knowledge 09 (45%), average knowledge 11 (55%), and good knowledge 00 (00%). Whereas post-test knowledge score was poor knowledge (00%), average knowledge 08 (40%), and good knowledge 12 (60%) after the structured teaching programme.

Table 3. Percentage and frequency of staff nurses of Sant Gajanan Maharaj Rural Hospital, Mahagaon according to their demographic variable.

Sr. No.	Socio Demographic variables	Frequency(*f*)	Percentage (%)
1	*Age of staff nurse (years)*		
	21–23	3	15%
	24–26	4	20%
	27–30	9	45%
	30 above	4	20%
	Total	20	100%
2	*Gender*		
	Male	6	30%
	Female	14	70%
	Total	20	100%
3	*Education*		
	ANM	5	25%
	GNM	9	45%
	B.Sc. Nursing	1	5%
	PB B.Sc.	5	25%
	Total	20	100%
4	*Religion*		
	Hindu	18	90%
	Muslim	1	5%
	Christian	1	5%
	Total	20	100%
5	*Hospital Department*		
	Medical ICU	4	20%
	Surgical ICU	5	25%
	NICU	1	5%
	OT	4	20%
	Ward	6	30%
	Total	20	100%
6	*Previous knowledge*		
	Yes	15	75%
	No	5	25%
	Total	20	100%

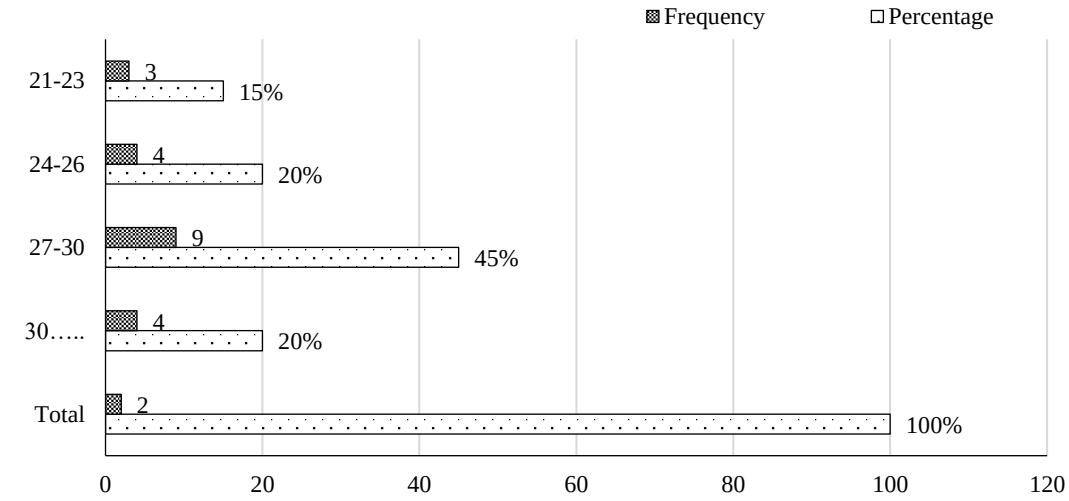

Figure 6. Bar diagram shows frequency and percentage distribution according to Age.

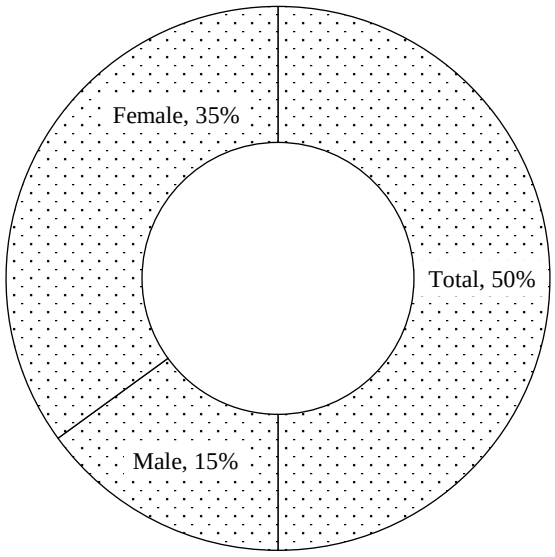

Figure 7. Doughnut diagram shows frequency and percentage distribution according to Gender.

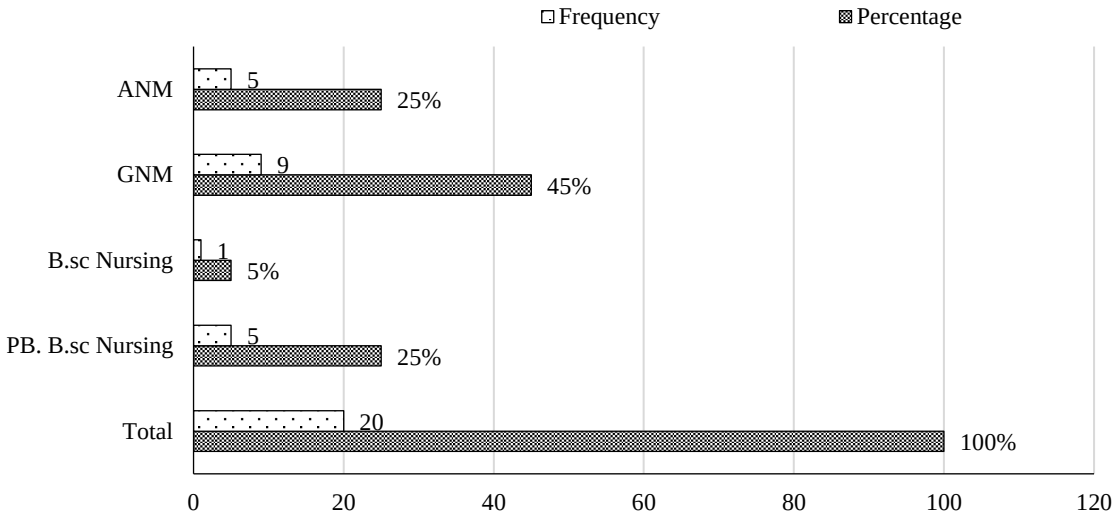

Figure 8. Bar diagram shows frequency and percentage distribution according to Education.

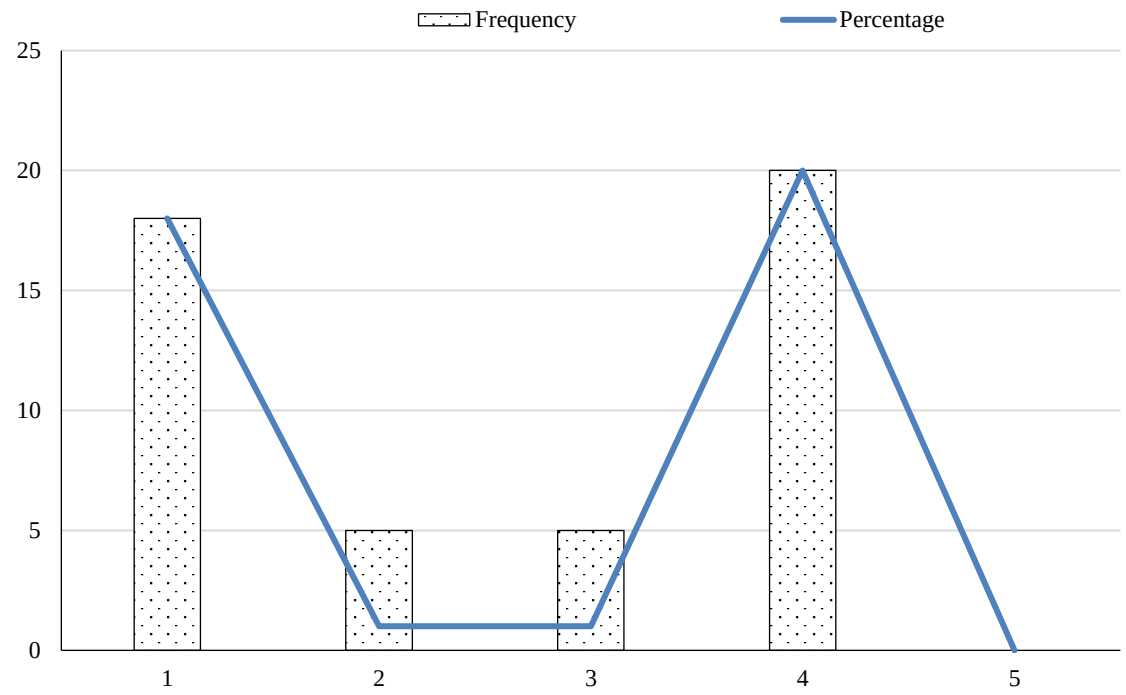

Figure 9. Custom combination diagram shows frequency and percentage distribution according to religion.

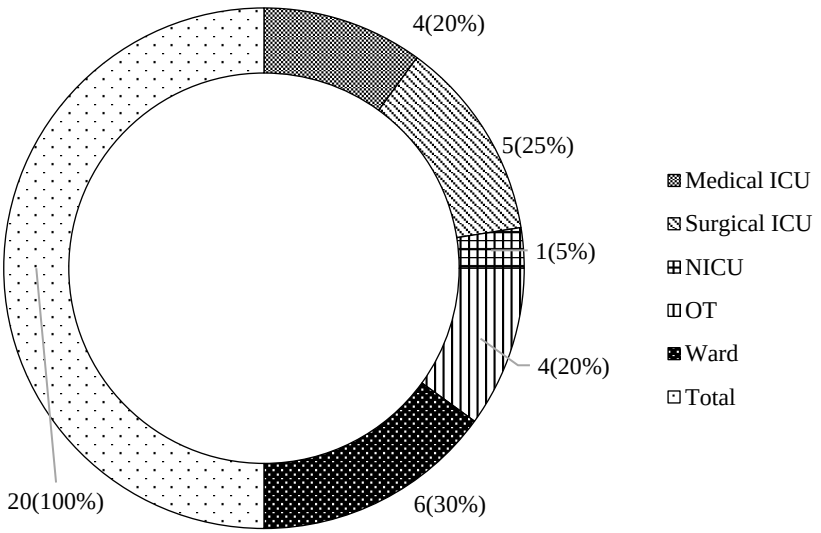

Figure 10. Doughnut diagram shows frequency and percentage distribution according to hospital department.

Table 4. Frequency and percentage distribution of pre-test and post-test knowledge score regarding electrocardiogram among staff nurses.

Level of knowledge	**Pre-test**		**Post-test**	
	Frequency (f)	***Percentage (%)***	***Frequency (f)***	***Percentage (%)***
Poor	09	45%	00	00
Average	11	55%	08	40%
Good	00	00	12	60%
Total	20	100%	20	100%

To Evaluate the Effectiveness of the Structured Teaching Program on Electrocardiogram Knowledge Among Staff Nurses by Comparing the Mean Pre-test Knowledge Score Using a Paired T-test

The data in Table 5 show that the mean post-test knowledge score among staff nurses was 20, significantly higher than the mean pre-test score of 13.85 with a standard deviation of 6.7. The computed paired "t" value of 29.3511 (df=19, p=0.005) is greater than the table value of 2.093, indicating a significant improvement in knowledge through the structured teaching program.

To Examine the Relationship Between Pre-test Knowledge Scores and the Selected Demographic Variables

Table 6 presents the relationship between pre-test knowledge scores and selected demographic variables using the chi-square (X^2) test. The results indicate that there was no significant association between the pre-test knowledge scores and the demographic variables.

Table 5. Overall mean, standard division, paired "t" value of pre-test and post-test.

Test	Mean	SD	Paired "t" test
Pre-Test	6.7	2.27	"t" cal=29.3511 df=19
Post-Test	13.85	2.37	

HS Highly Significant, df = degree of freedom

Table 6. Association between demographic variables and pre-test level of knowledge of staff nurses.

Sr. No.	Demographic variable	Categories	Score						Total		Chi squire value
			Poor		*Average*		*Good*				
			f	%	*f*	%	*f*	%			
1	Age (years)	21–23	03	15%	00	00	00	00	03	15%	X^2=7.6 Df=6 NS
		24–26	02	10%	02	10%	00	00	04	20%	
		27–30	01	5%	08	40%	00	00	09	45%	
		30 above	03	15%	01	5%	00	00	04	20%	
		Total	09	45%	11	55%	00	00	20	100%	
2	Sex	Male	04	20%	02	10%	00	00	06	30%	X^2=1.4 Df=2 NS
		Female	05	25%	09	45%	00	00	14	70%	
		Total	09	45%	11	55%	00	00	20	100%	
3	Education	ANM	04	20%	01	5%	00	00	05	25%	X^2=3.5 Df=6 NS
		GNM	05	25%	04	20%	00	00	09	45%	
		B.Sc. Nursing	00	00	01	5%	00	00	01	5%	
		PB B.Sc. Nursing	00	00	05	25%	00	00	05	25%	
		Total	09	45%	11	55%	00	00	20	100%	
4	Religion	Hindu	08	40%	10	50%	00	00	18	90%	X^2=2.04 Df=4 NS
		Muslim	00	00	01	5%	00	00	01	5%	
		Christian	01	5%	00	00	00	00	01	5%	
		Total	09	45%	11	55%	00	00	20	100%	
5	Hospital Department	Medical ICU	00	00	04	20%	00	00	04	20%	X^2=3.17 Df=8 NS
		Surgical ICU	02	10%	03	15%	00	00	05	25%	
		NICU	00	00	01	5%	00	00	01	5%	
		OT	03	15%	01	5%	00	00	04	20%	
		Ward	04	20%	02	10%	00	00	06	30%	
		Total	09	45%	11	55%	00	00	20	100%	
6	Previous knowledge	Yes	04	20%	11	55%	00	00	15	75%	X^2=22.44 Df=2 NS
		No	05	25%	00	00	00	00	05	25%	
		Total	09	45%	11	55%	00	00	20	100%	

Table 7 shows the relationship between pre-test knowledge scores and selected demographic variables using the chi-square (X^2) test. The results demonstrate that there was no significant association between the pre-test knowledge scores and the demographic variables.

DISCUSSION

This study was conducted to evaluate the impact of a structured teaching program on staff nurses' knowledge of electrocardiograms in a selected hospital in Mahagaon [29–32].

The findings of the study are discussed under the following headings:

1. Results related to the sample characteristics.
2. Results related to staff nurses' knowledge of electrocardiograms.
3. Results on the correlation between pre-test knowledge scores and selected demographic variables.
4. Results on the effectiveness of the structured teaching program in improving staff nurses' knowledge by comparing pre-test and post-test scores.

Table 7. To find out the association between post-test knowledge scores with their selected demographic variables.

Sr. No.	Demographic variable	Categories	score						Total		Chi squire value
			Poor		*Average*		*Good*				
			f	%	*f*	%	*f*	%			
1	Age (years)	21–23	00	00	03	15%	00	00	03	15%	X^2=6.1 Df=6 NS
		24–26	00	00	02	10%	02	10%	04	20%	
		27–30	00	00	01	5%	08	40%	09	45%	
		30 above	00	00	02	10%	02	10%	04	20%	
		Total	00	00	08	40%	12	60%	20	100%	
2	Sex	Male	00	00	04	20%	02	10%	06	30%	X^2=1 Df=2 NS
		Female	00	00	06	30%	08	40%	14	70%	
		Total	00	00	10	50%	10	50%	20	100%	
3	Education	ANM	00	00	04	20%	01	5%	05	25%	X^2=5.8 Df=6 NS
		GNM	00	00	06	30%	03	15%	09	45%	
		B.Sc. Nursing	00	00	00	00	01	5%	01	5%	
		PB B.Sc. Nursing	00	00	00	00	05	25%	05	25%	
		Total	00	00	10	50%	10	50%	20	100%	
4.	Religion	Hindu	00	00	09	45%	09	45%	18	90%	X^2=1 Df=4 NS
		Muslim	00	00	00	00	01	5%	01	5%	
		Christian	00	00	01	5%	00	00	01	5%	
		Total	00	00	10	50%	10	50%	20	100%	
5	Hospital Department	Medical ICU	00	00	01	5%	03	15%	04	20%	X^2=6.8 Df=8 NS
		Surgical ICU	00	00	01	5%	04	20%	05	25%	
		NICU	00	00	00	00	01	5%	01	5%	
		OT	00	00	03	15%	01	5%	04	20%	
		Ward	00	00	05	25%	01	5%	06	30%	
		Total	00	00	10	50%	10	50%	20	100%	
6	Previous knowledge	Yes	00	00	06	30%	09	45%	15	75%	X^2=2.5 Df=2 NS
		No	00	00	05	25%	00	00	05	25%	
		Total	00	00	11	55%	09	45%	20	100%	

NS = not significant.

Findings Related to Sample Characteristics

- *Age of the staff nurse:* Among them, the majority (15%) of staff nurses were aged between 21 and 23 years, while the fewest (20%) were aged above 30 years.
- *Sex of staff nurses:* It shows that the majority were females (70%), while the minimum were males (30%).
- *Educational qualification of staff nurses:* It shows that the majority were GNM (45%), while the minimum were PB B.Sc. (25%).
- *Religion of staff:* The majority of nurses were Hindu (90%), while the fewest (5%) were Muslim.
- Hospital departments show that the majority were from the ward (30%), while the fewest were from the NICU (5%).
- *Previous Knowledge:* The majority of subjects (75%) had previous knowledge, while the fewest (25%) did not have prior knowledge.

Finding Related to Knowledge of Staff Nurses Regarding Electrocardiogram

A similar study was conducted, and the findings revealed that during the pre-test, most of the participants had an inadequate level of knowledge regarding electrocardiogram. After the structured teaching program was administered, there was a significant improvement in the participants' knowledge, with the majority (90%) achieving an adequate knowledge score, and 10% of the participants attaining a moderate knowledge score regarding cardiac problems.

This was supported by a study aimed at summarizing the findings from a literature review focusing on cardiac issues among staff nurses in a selected hospital. A qualitative deductive content analysis was employed to explore the existing knowledge about cardiac views among staff nurses.

Findings in Association Between Pre-test Knowledge Score with Selected Demographic Variables

The results show that no significant relationship was found between the mean pre-test knowledge scores and the selected demographic variables.

Findings Related to Effectiveness of Structured Teaching Programme on Knowledge of Staff Nurses by Comparing Pre-test and Post-test Knowledge Score

Therefore, since the post-test knowledge score exceeded the pre-test knowledge score, the research hypothesis was confirmed [33–35].

CONCLUSION

We assessed the knowledge before giving structure teaching programme, and found that the staff nurses had poor knowledge. After having given the structured teaching programme, the knowledge was improved. Nursing staff face the challenge of delivering consistent and high-quality care. As a result, it is crucial for nurses to play an active role in aiding patients' recovery and enhancing their functional capabilities. Despite all preventive measures, unexpected situations can still arise. Increasingly, nurses are specializing in cardiology, and the role of cardiac nurses is progressively evolving to include liaison nursing.

The findings of this study have significance for various aspects of nursing, such as practice, education, administration, and research.

Nursing Practice

1. The field of cardiac nursing holds significant responsibility for safeguarding the health of cardiac patients.
2. Nurses should be equipped with up-to-date knowledge in cardiology to effectively educate other nurses.
3. Cardiac specialist nurses should take the initiative to raise awareness among staff nurses in selected hospitals about cardiac issues to prevent heart diseases.

4. Nurses working in various healthcare settings are essential in promoting health, maintaining well-being, and preventing diseases.
5. Nurses and healthcare providers are vital in motivating nurses to share cardiac-related information with their patients.
6. Nurses should organize health education campaigns on cardiology across all healthcare settings.

Nursing Education

1. The study emphasizes the need for staff nurses to develop strong teaching skills in cardiology.
2. The nurse educator should focus on health education related to preventing cardiac diseases as part of the staff's learning experience.
3. The nurse educator should organize in-service education programs (such as seminars and workshops) for staff nurses on cardiology and disease prevention.
4. The nurse educator should offer staff the opportunity to actively engage in cardiology program.

Nursing Administration

1. Nurse administrators should provide guidance and supervision to staff nurses on electrocardiograms and plan for regular in-service education sessions.
2. As an administrator, the nurse plays a crucial role in educating professionals and shaping policies, such as implementing mass health education initiatives within the hospital.
3. Nurse administrators should plan training programs well in advance.

Nursing Research

1. The core purpose of research is to develop a body of knowledge in nursing.
2. Nursing research is the primary driver of growth within the nursing profession.
3. The study's findings can be generalized through replication, allowing nurse researchers to incorporate evidence-based practices.
4. This study will serve as an important resource for future researchers.

Recommendation

1. A similar study could be carried out with a larger sample to validate and broaden the applicability of the results.
2. This study will serve as a reference for research scholars.
3. Greater emphasis should be placed on evidence-based nursing practice to enhance awareness among staff nurses in selected hospitals.
4. A non-experimental study could be conducted to evaluate the impact of a self-instructional module on staff nurses' knowledge of electrocardiograms.

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