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RESEARCH ARTICLE

Evaluation of Clinical Indications for Electrocardiography at Meenakshi Medical College Hospital and Research Institute

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Abstract: The present study was undertaken to evaluate the clinical indications for ECG in MMCHRI. Patterns of utilization in cardiovascular versus non-cardiovascular presentations were analyzed, with attention to appropriateness and unnecessary estimations. A total of 100 participants were included, comprising 36% males and 64% females, with the majority aged 21–30 years. Pregnancy (20%) and chest pain (16%) were the leading reasons for ECG evaluation. Overall, 26% of participants showed abnormal ECG findings, 17% had borderline changes, and 57% were normal. Abnormalities were equally distributed between cardiac (13%) and non-cardiac (13%) patients. The highest rate of abnormalities was observed in the cardiac outpatient department (13%), followed by general medicine (6%). Age-wise, most abnormalities and borderline changes occurred in the 41–70 years group. Obstetrics and gynecology patients, mainly in the 20–30 years age group, demonstrated mostly borderline changes. These findings highlight the need for rational, guideline-based ECG utilization to optimize patient care and ensure cost-effective healthcare delivery.

Keywords: Electrocardiogram (ECG), abnormal ECG, borderline ECG, cardiac patients, non-cardiac patients, age distribution, clinical indication.

INTRODUCTION

Electrocardiography (ECG) remains one of the most indispensable and widely performed diagnostic tests in clinical medicine. First introduced over a century ago, it has evolved into a frontline tool for evaluating cardiac function by recording the heart's electrical activity. It is inexpensive, non-invasive, widely accessible, and capable of providing immediate information on cardiac rhythm, conduction disturbances, ischemia, and structural abnormalities [1]. In emergency settings, the rapid performance of an ECG can be lifesaving by enabling early detection of acute coronary syndromes, arrhythmias, and cardiac arrest rhythms, thereby facilitating prompt management decisions [2].

The global burden of cardiovascular diseases (CVDs) underscores the significance of ECG as a diagnostic and screening modality. According to the World Health Organization, CVDs account for an estimated 17.9 million deaths annually, making them the leading cause of mortality worldwide [3]. In India, the incidence of ischemic heart disease and sudden cardiac deaths has been steadily rising, with patients often presenting late or with atypical symptoms [4]. In such settings, ECG offers a quick and effective means of initial assessment, particularly in resource-constrained environments where advanced imaging modalities may not be readily available. However, despite its value, concerns regarding the inappropriate or excessive utilization of ECG have been widely reported. Many studies indicate that ECGs are frequently performed in situations where they provide limited or no clinical benefit, such as routine preoperative evaluations, health check-ups in asymptomatic individuals, or as part of blanket screening programs [5,6]. While these practices may be well-intentioned, they add to healthcare costs, strain hospital resources, and may contribute to patient anxiety or unnecessary follow-up investigations. Conversely, there are instances of underutilization, where patients with high-risk symptoms like chest pain, syncope, or unexplained palpitations fail to receive timely ECG evaluation, resulting in delayed diagnosis and poorer clinical outcomes [7].

International guidelines such as those from the American College of Cardiology (ACC), American Heart Association (AHA), and European Society of Cardiology (ESC) emphasize that ECG should be performed only in the presence of appropriate clinical indications [8,9]. For instance, patients presenting with chest pain suggestive of ischemia, arrhythmic symptoms, syncope, or unexplained shortness of breath clearly warrant ECG evaluation. On the other hand, in low-risk patients without relevant symptoms or risk factors, routine ECG is not recommended. Despite these recommendations, adherence is often inconsistent across healthcare systems. A variety of factors—including defensive medical practices, institutional protocols, and physician preference—contribute to this variability [10]. In the Indian context, the problem of balancing clinical necessity with resource utilization is particularly relevant. Tertiary care teaching hospitals, such as Madha Medical College and Hospital Research Institute (MMCHRI), serve a heterogeneous population with both cardiac and non-cardiac complaints. ECGs are routinely requested in emergency departments, outpatient clinics, and inpatient wards, irrespective of the primary diagnosis. While this practice ensures broad coverage, it may also result in significant proportions of ECGs being performed without valid indications. Studies from similar settings have highlighted the dual challenge of

both overuse and underuse, stressing the importance of local audits to guide rational utilization [11].

Against this background, the present study was undertaken to evaluate the clinical indications for ECG in MMCHRI. By analyzing patterns of utilization in cardiovascular versus non-cardiovascular presentations, assessing appropriateness against presenting symptoms and final diagnoses, and quantifying unnecessary estimations, the present study seeks to provide evidence that may guide more rational, guideline-based use of ECG. Such findings could not only optimize patient care but also contribute to cost-effective healthcare delivery in resource-limited settings.

MATERIALS AND METHODOLOGY:

This study was designed as a cross-sectional observational, descriptive study conducted at Meenakshi Medical College Hospital &Research Institute (MMCH&RI) over a period of three months. Institutional Ethical Committee clearance was obtained prior to the commencement of the study (**IEC Approval No: MMCH&RI/UG/AHS/15/MAY/25**). A total of 100 patients were included in the study. The study population comprised both inpatients and outpatients of either sex, aged between 10 and 85 years, who underwent electrocardiography (ECG) for diagnostic purposes. Pregnant women were also included. Patients who had repeat ECG recordings within 24 hours without valid clinical indications were excluded. Data collection focused on the clinical indications for ECG, patient demographics, and categorization of cases as cardiovascular or non-cardiovascular based on presenting symptoms and final diagnosis. The collected data were entered in Microsoft Excel and subjected to descriptive statistical analysis. Frequency distribution was computed for each study variable, and results were expressed as percentages. This approach was used to evaluate the pattern of ECG utilization, the proportion of cases with cardiovascular versus non-cardiovascular indications, and the appropriateness of ECG requests based on presenting symptoms and final diagnoses.

RESULTS AND DISCUSSION

The demographic distribution of the study participants was analyzed, with a total of 100 individuals included in the study. Among them, 36 percent were male and 64 percent were female (Table 1). The age wise distribution of study population is given in Fig 1. The population was categorized into 8 group based on the age, less than 20, 21-30, 31-40, 41-50, 51-60, 61-70 and 71-80 respectively. The Result showed 5 percent belongs to less than 20; 25 percent belongs to 21-30; 16 percent belongs to 31-40; 21 percent belongs to 41-50; 14 percent belongs to 51-60; 14 percent belongs to 61-70; 4 percent belongs to 71-80w; and 1 percent belongs to 81-90.

Gender	Frequency (n)	Percentage %
Male	**36**	**36**
Female	**64**	**64**

Table 1: Gender-wise Distribution

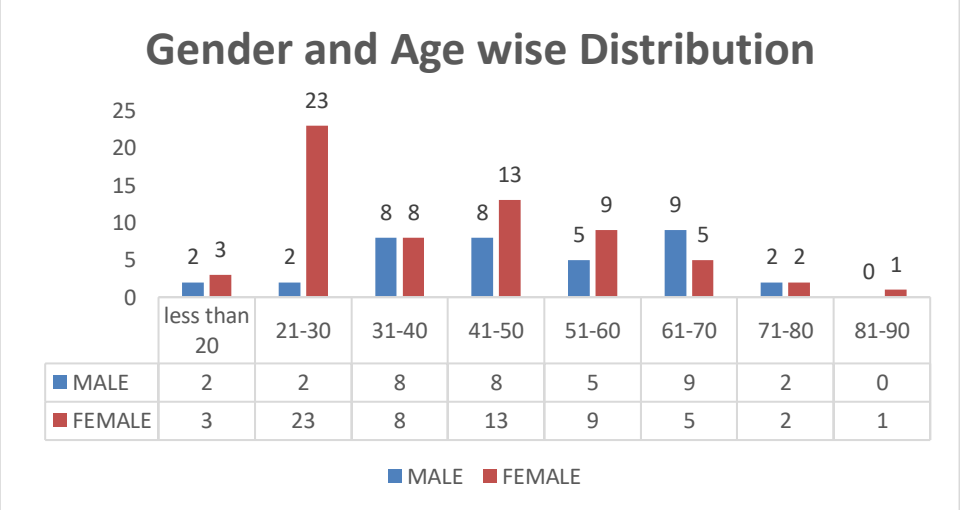

Figure 1: Gender and Age wise Distribution. The values are represented in percentage.

Indication	Percentage of study population
Back pain	1
Bleeding ,while urination	1

	Bradycardia	1
	Breathlessness	2
	Cardiac opinion	2
	Cervical Necrosis	1
	checkup(after cardiac surgery)	2
	Checkup for asthma	1
	Chest pain	16
	Cyst in Uterus	1
	Cyst in kidney	1
	Family planning	1
	Dyspnea	1
	Dizziness,	2
	Fibroid in Breast	1
	Kidney Stone	4
	Left hand tumor	1
	knee and leg ache	1
	General checkup	5
	Hernia Removal	3
	Master checkup	8
	Mitral valve prolapse	1
	Mouth Cancer	1
	Piles removing	1
	Neck pain radiate till right hand	1
	Multi nodular colloid goiter	1
	Post Thyroidectomy	1
	Psychiatric issues	1
	Regular Checkup	6
	Pregnancy	20
	Squint eye	1
	Tumor in Uterus	1
	Tumor in urinary bladder	1
	Side abdominal pain	1
	Shoulder pain (accidently fall down)	1
	Tumor in esophageal tube	1
	Swelling of stomach, Breathlessness	1
	Uterus Removed Before 1year	1
	Uterus tumor	1
	Eye Operation	2

Table 2: Common Indication for ECG in the study Population

Figure 2:

Common Indication for ECG in the study Population

ECG outcome in various department is given in Figure 3 and Table 3. Among the various clinical indications, ECG findings showed varying patterns of abnormalities. In pregnancy cases (n=20), no abnormalities were detected, while 4% of participants exhibited borderline ECG changes. Among patients presenting with chest pain (n=16), 9% demonstrated abnormal ECG findings and 4% showed borderline changes. In those undergoing comprehensive checkups (n=8), abnormalities were noted in 3% and borderline changes in 1% of cases. Similarly, among individuals attending for regular checkups (n=6), 3% showed abnormal ECG patterns and 1% exhibited borderline findings. In the general checkup group (n=5), 1% of participants were found to have abnormal ECG results, while no borderline findings were observed. These results indicate that chest pain cases had the highest proportion of abnormal ECG changes, whereas pregnancy cases demonstrated only borderline variations without definitive abnormalities.

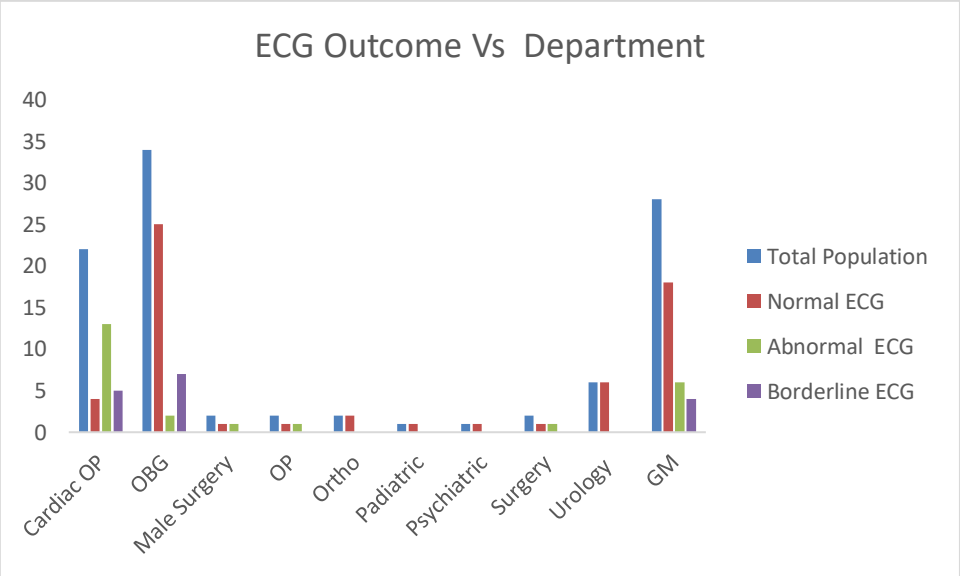

Figure 3: ECG indication and findings represented in various Department. The values are represented in percentage

Department	Total Population	Normal ECG	Abnormal ECG	Borderline ECG
Cardiac OP	22	4	13	5
OBG	33	24	2	7
Male Surgery	2	1	1	0
OP	2	1	1	0
Ortho	3	2	1	0
Pediatric	1	1	0	0
Psychiatric	1	1	0	0
Surgery	2	1	1	0
Urology	6	4	1	1
GM	28	18	6	4

Table 3: ECG indication and findings among various Department. The values are represented in percentage

Distribution of Study population in cardiac and Non-cardiac patient is represent in Table 4 and Figure 5. The Study particants can be divided into 2 categories based on the cardiac health condition. it includes cardiac patient (22 %) and non-cardiac patient (78 %).Out of the overall population ECG abnormality observed in 26 percentage of Patient , (it includes cardiac patients 13 and non-cardiac patients 13). Borderline ECG variations observed in 17 percentage of overall study subject. (it include 5 cardiac patients, 12 non-cardiac patient). The normal ECG is observed in 57 % of overall population (it includes 4 cardiac patients, 57 non-cardiac patients). ECG indication can variable based on patient age. In our study population nearly 43% patient has abnormal and Border line ECG finding. we categorised the population into 7 groups

Distribution of Study population	Population
Cardiac Condition	22
Non Cardiac Condition	78
Total	100

Table 4: Distribution of Study population: Cardiac VS Non Cardiac Patients . The values are represented in percentage

ECG Finding among Cardiac and Non - cardiac study participant are given in figure 5 .

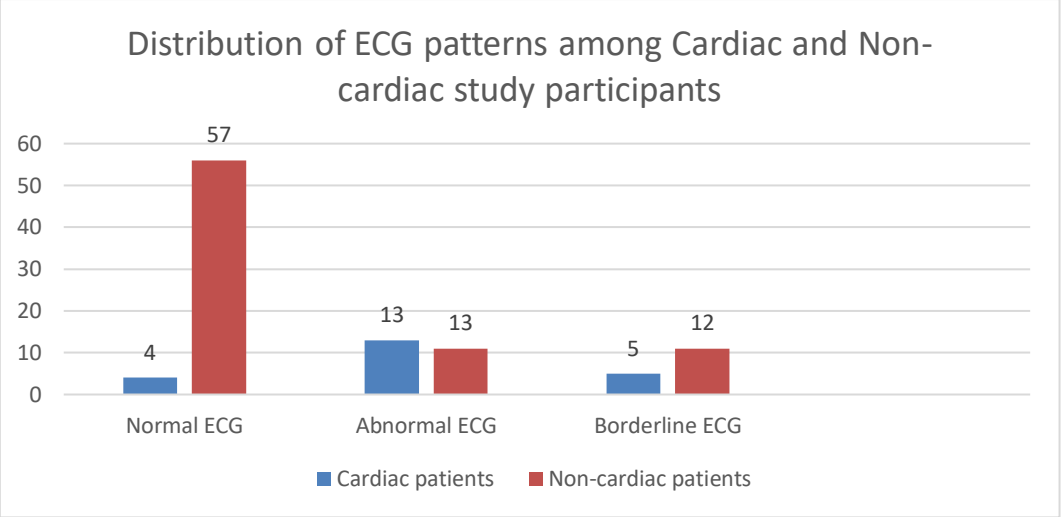

Figure 5: Distribution of ECG patterns among Cardiac and Non-cardiac study participants. The values are represented in percentage

Various reasons for ECG indication in cardiac patient in our study participant is given in fig 6and Table 5. Age distribution of cardiac and non-cardiac patient ECG findings (abnormal and Border line ECG) among study population is given in Table 6

Electrocardiogram (ECG) indications and findings in our study population varied considerably with age and clinical department. Overall, 43% of participants demonstrated ECG abnormalities, comprising 26% abnormal and 17% borderline findings. Age-wise stratification revealed that borderline ECG changes were first observed in the 20–30 years group (7% non-cardiac cases). In the 31–40 years group, 1% of cardiac and 1% of non-cardiac patients showed abnormal ECGs, while another 1% of non-cardiac patients had borderline changes. In the 41–50 years group, abnormalities were more pronounced, with 3% cardiac and 3% non-cardiac patients exhibiting abnormal findings, and 2% each showing borderline changes. The 51–60 years group demonstrated 3% cardiac and 3% non-cardiac abnormalities, with borderline changes in 1% of cardiac and 2% of non-cardiac patients. Among individuals aged 61–70 years, abnormal ECGs were noted in 5% of cardiac and 3% of non-cardiac patients, while 2% of cardiac patients exhibited borderline changes. In the 71–80 years group, 1% of cardiac and 2% of non-cardiac patients showed abnormal ECGs, whereas in the oldest age group (81–90 years), 1% of non-cardiac patients demonstrated abnormalities.

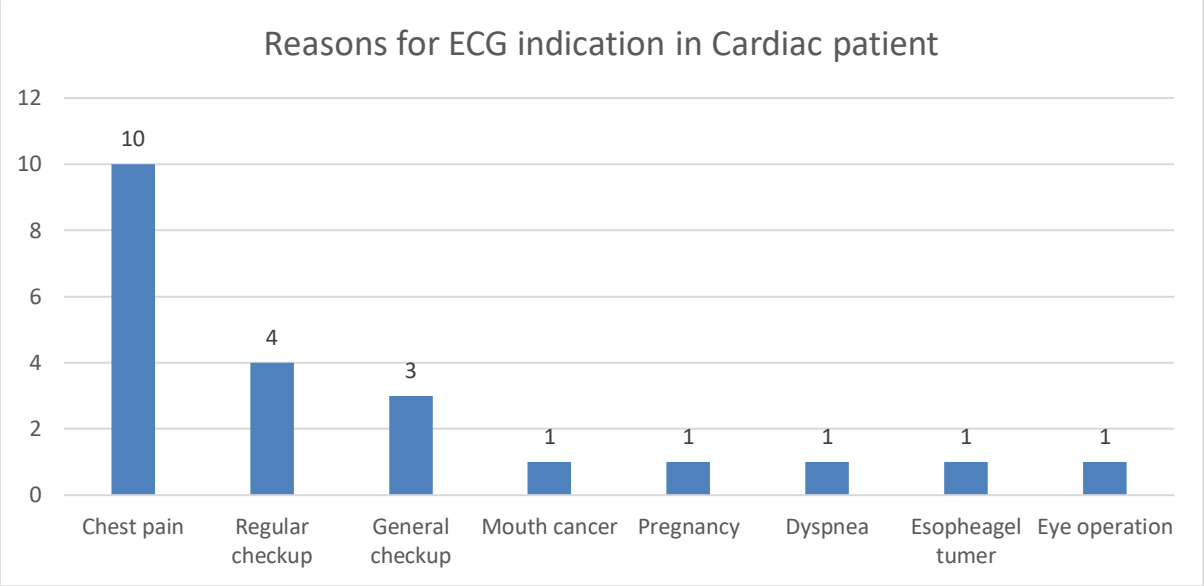

Figure 6: Reasons for ECG indication in Cardiac patient

Condition	Frequency	Percentage (%)
Chest Pain	10	45.45%
Regular Checkup	4	18.18%
General Checkup	3	13.64%
Mouth Cancer	1	4.55%
Pregnancy	1	4.55%
Dyspnea	1	4.55%
Esophageal Tumor	1	4.55%
Eye Operation	1	4.55%

Table 5: Reasons for ECG indication in Cardiac patient

Age Group	Cardiac Abnormal	Cardiac Borderline ECG	Non-Cardiac Abnormal	Non-Cardiac Borderline ECG
20-30	**0**	**0**	**0**	**7**
31-40	**1**	**0**	**1**	**1**
41-50	**3**	**2**	**3**	**2**
51-60	**3**	**1**	**3**	**2**
61-70	**5**	**2**	**3**	**0**
71-80	**1**	**0**	**2**	**0**
81-90	**0**	**0**	**1**	**0**
Total	**13**	**5**	**13**	**12**

Table 6: Distribution of Age in ECG Finding

Distribution of ECG Finding (Abnormal-Borderline ECG) in Study Population among Departments Are Given in Table 7. When categorized department-wise, the cardiac department accounted for the highest proportion of ECG variations, with 13% abnormal and 5% borderline findings. This was followed by general medicine (6% abnormal, 4% borderline), surgery (4% abnormal), urology (1% abnormal, 1% borderline), outpatient services (1% abnormal), orthopedics (1% abnormal), and obstetrics and gynecology, where 7% of patients had borderline ECGs. Notably, 18% of all cardiac patients demonstrated ECG changes (13% abnormal, 5% borderline).

Department	**Abnormal**	**Borderline ECG**
Cardiac OP	**13**	**5**
General Medicine	**6**	**4**
Surgery Ward	**4**	**0**
Urology	**1**	**1**

OPD	**1**	**0**
Ortho	**1**	**0**
OBG	**0**	**7**

Table 7: ECG Finding (abnormal and borderline ECG) among department

Various Reason for Cardiac Patients ECG Finding (Abnormal-Borderline) are Given in Figure 7.The most frequent abnormal ECG variations were linked to chest pain (7%), followed by routine checkups (3%), general checkups (2%), and dyspnea (1%). Borderline ECG changes were observed in 5% of cardiac patients, most commonly during chest pain evaluation (3%), preoperative eye surgery assessment (1%), and general checkup (1%). These results suggest that both age and clinical indication strongly influence the prevalence and distribution of ECG abnormalities.

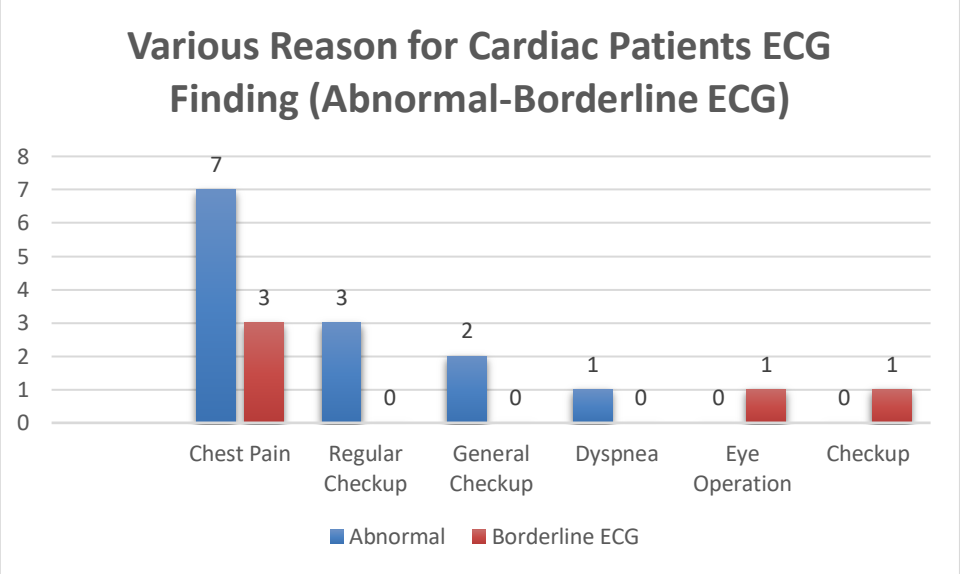

Figure 7: Various Reason for Cardiac Patients ECG Finding (Abnormal-Borderline)

In this study of 100 participants, 36% were male and 64% female, with the majority aged between 21–30 years. ECGs were performed for various reasons, with pregnancy (20%) and chest pain (16%) being the most common indications. Overall, 26% of participants showed abnormal ECGs, 17% had borderline findings, and 57% were normal.

Abnormalities were equally distributed between cardiac and non-cardiac patients. The highest rate of ECG abnormalities was observed in the Cardiac OP department (13%), followed by General Medicine (6%). Among age groups, most abnormal and borderline findings were noted in participants aged 41–70 years.This highlights the importance of routine ECG screening across departments, particularly in cardiac and middle-aged populations.

CONCLUSION

Our findings indicate that nearly half of the study population exhibited abnormal or borderline ECG changes, with the burden highest in cardiac cases and middle-aged groups. These results emphasize the clinical value of ECG as a simple, non-invasive tool for identifying early cardiac risk in both symptomatic and asymptomatic patients.

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REFERENCES:

1. Goldberger AL, et al. *Clinical Electrocardiography: A Simplified Approach*. 9th ed. Elsevier; 2018.
2. Surawicz B, Knilans TK. *Chou's Electrocardiography in Clinical Practice*. 6th ed. Saunders; 2008.
3. Rawshani A, et al. ECG monitoring in hospital: cardiac arrest and factors associated with survival. *Circulation*. 2020;141(8):610–619.
4. World Health Organization. Cardiovascular diseases (CVDs). Fact sheet. 2021.
5. Prabhakaran D, et al. Cardiovascular diseases in India: current epidemiology and future directions. *Circulation*. 2016;133:1605–1620.
6. Lin MP, et al. Overuse of cardiac testing. *JAMA Intern Med*. 2013;173(7):593–601.
7. Smetana GW, et al. Preoperative testing and risk assessment. *N Engl J Med*. 2019;380:1322–1331.
8. Kanzaria HK, et al. Frequency of unnecessary electrocardiograms in emergency departments. *Am J Emerg Med*. 2016;34(6):943–948.

9. Amsterdam EA, et al. 2014 AHA/ACC guideline for the management of patients with non–ST-elevation acute coronary syndromes. *Circulation*. 2014;130:e344–e426.
10. Roffi M, et al. 2015 ESC guidelines for the management of acute coronary syndromes. *Eur Heart J*. 2016;37:267–315.
11. Chan PS, et al. Appropriateness of cardiac diagnostic testing in routine practice: insights from the National Cardiovascular Data Registry. *JAMA*. 2011;306(18):1993–2000.
12. Shanafelt TD, et al. Utilization of ECG in non-cardiac preoperative evaluations: a review. *Mayo Clin Proc*. 2018;93(8):1112–1120.