



Initial Management of Myocardial Infarction Among Nurses in the Critical Care Units at Orotta & Halibet National Referral Hospitals, Asmara, Eritrea

Senait Abraham Tesfamichael^{1,*}, Raja Antonysamy², Sebastian Schulz-Stuebner², Ghidey Gebreyohannes^{3,4}, Laban Lebahati Simel^{3,4}, Eyasu Habte Tesfamariam⁴

¹Department of Anaesthesia and Critical Care, School of Nursing, Asmara College of Health Sciences, Asmara, Eritrea

²Department of Anaesthesia and Critical Care, Asmara College of Health Sciences, Asmara, Eritrea

³Department of Nursing, Asmara College of Health Sciences, Asmara, Eritrea

⁴Department of Epidemiology and Biostatistics, School of Public Health, Asmara College of Health Sciences, Asmara, Eritrea

Email address:

senaitabrahamW@gmail.com (S. A. Tesfamichael)

*Corresponding author

To cite this article:

Senait Abraham Tesfamichael, Raja Antonysamy, Sebastian Schulz-Stuebner, Ghidey Gebreyohannes, Laban Lebahati Simel, Eyasu Habte Tesfamariam. Initial Management of Myocardial Infarction Among Nurses in the Critical Care Units at Orotta & Halibet National Referral Hospitals, Asmara, Eritrea. *American Journal of Nursing and Health Sciences*. Vol. 2, No. 1, 2021, pp. 6-17.

doi: 10.11648/j.ajnh.20210201.12

Received: February 5, 2021; Accepted: February 14, 2021; Published: March 30, 2021

Abstract: Background: Myocardial infarction is one of the most common coronary heart lesions referred to as an invisible epidemic in the 21st century. Despite the growing burden, myocardial infarction continues to receive a relatively low public health priority in Eritrea as it is evident in many other African countries. A nurse must have adequate knowledge regarding the underlying mechanisms, subtle and obvious signs and must also possess competency of the emergency management. Aim: This study aimed to assess the knowledge of nurses of the Emergency and Intensive Care Unit nurses regarding initial management of myocardial infarction at the two National Referral Hospitals, in Asmara, Eritrea. Methods: A quantitative, cross sectional study was conducted at Emergency and Intensive Care Units. Data was collected from all the two units using a researcher administered structured questionnaire which was deliberated upon by a team of competent professional in the field of research before data collection. Analysis was carried out in SPSS (version 22) using chi-square, and independent t-test. The result was tested at significance level of 0.05. Result: The study participants were 54 nurses from both hospitals. 40.7% of the nurses were found with poor level of knowledge. Nurses in the age group between 26-35 years were observed to have better knowledge compared to ≤ 25 years ($p=0.006$) as well as 36 years or above ($p=1.000$). Significant knowledge difference was observed among associate, diploma and degree nurses ($P=0.002$). The Emergency and Intensive Care Units were found to have a significant association with knowledge at ($p=0.001$). There was no significant association ($p=0.908$) in Emergency and ($p=0.760$) in ICU in the level of knowledge among the staff within each unit. Conclusion: Poor level of knowledge regarding initial management of myocardial infarction was evident among the large number of the nurses. This study recommends up grading and refresher courses to all the nurses who are working in Emergency and intensive care units at the above referral hospitals.

Keywords: Myocardial Infarction, Intensive Care Unit, Emergency Unit, Initial Management, Knowledge, Nursing Staff

1. Introduction

Myocardial infarction (MI) is one of the most frequent cardiovascular diseases that are becoming an epidemic in the new era of non-communicable diseases (NCDs). Since it is

an emergency disease, if not treated on time, it may lead to permanent injury or death of the heart muscle [11, 15, 17].

A retrospective study documented that MI rates increase progressively with increasing Coronary artery disease (CAD), ranging from 0.11% among patients with no apparent CAD to 2.47% among patients with the symptomatic CAD [15].

Due to the severity of the condition and critical status of the patients the initial hours of admission must be supervised by qualified health care providers among which are nurses, who are the closest to the patient. Myocardial infarction is a serious disease which demands standardized care protocols and policies for nurses to achieve good outcomes through better care.

According to Watson's and Nola Pender's theories of nursing, nurses should be equipped with sound knowledge and theoretical bases for health promotion which enables them to help individuals, families and community to keep healthy. Nurses must incorporate scientific knowledge and technical advances into their practice to assist the patients in remaining well and functioning at the maximum level [8]. Scientific and technological advancement in critical care units demands that the nurses upgrade their knowledge to be able to identify life threatening arrhythmias on the electrocardiogram and perform emergency resuscitation measures. In reference to the global and regional trends, MI has become one of the common medical problems in Eritrea that require urgent action in emergency unit and ICU [26]. According to World Health Organization statistical report of the year 2014 were 157.9, 149, 59.8, 50.1, 36.1 per 100,000 of patients; in Yemen, Libya, South Sudan, Somalia and Ethiopia, respectively and that of Eritrea were 79.8 [27].

A review study done between 1997 and 2001 at Halibet National Referral Hospital, Asmara, Eritrea revealed that the incidence of MI was 4.35 per 1000 admissions with a mortality rate of 35.8% [22]. In another retrospective study done at Orotta National Referral Teaching Hospital (ONRTH) in 2017 indicated that the prevalence rate of acute coronary syndrome was 8.5%. Majority (86.6%) of admissions were reported from urban areas with an increasing of ICU bed occupancy rate from 9.3 in 2015 to 11 days in 2017 [1]. This high morbidity and mortality rate had no clear explanation, even though the difference in the management among the health providers and the knowledge gap could have been contributory [22]. Due to its associated lead in mortality and the highest number of in patients, MI should be given high priority in national health policies and preventive health care programs. A deficit of trained intensive and emergency care specialized nurses in Eritrea has resulted in the use of general nurses in ER and ICU and are supposed to have adequate knowledge on the initial identification and management of MI. Failure to assess patient's conditions and monitor the changes properly contributes to an inadequate management. Assessing and nurturing the knowledge of health care providers, especially nurses, is essential in order to achieve the Eritrean Sustainable Development Goals -3 (SDG); which states "to ensure healthy lives and promote well-being for all at all ages" [24].

According to the reports of Orotta National Referral Hospital ICU, the patient's average stay was reported to be as follows 6.15, 8.9 and 9.3 days for the years 2012, 2013 and 2015, respectively. There has never been any research done

related to the nurse's knowledge on the initial management of MI in the above health facilities according to the available literature reviewed by this study. Even though mortality of patients secondary to MI is expected to have multiple causes, this research tried to assess the knowledge of ER and ICU nurses regarding initial management of MI in order to identify any gaps.

2. Methods

2.1. Study Design

This study was a cross sectional by nature which used quantitative approaches to assess the knowledge of nurses at emergency and ICU regarding the initial management of MI.

2.2. Study Sites

The study was carried out at Orotta and Halibet National Referral and Teaching Hospitals in the adult intensive care Department which included emergency and ICU in November to December 2017. The two hospitals are located in Asmara, the capital city of Eritrea. These are the National Referral Hospitals available in the country which provide health care service at tertiary level including intensive care and emergency services. The hospitals have different departments that provide comprehensive health care services for all age groups of people from the entire country. Orotta National Referral Teaching Hospital has a total number of 517 beds in all the departments. Similarly Halibet National Referral Hospital (HNRH) accommodates a total of 236 beds for inpatient and an average length of stay of eight days based on the statistical report in July 2017.

2.3. Study Population

Nurses who were working in the emergency and ICU of the referral hospitals met the inclusion criteria for this study. The nurse's educational level was as follows; certificate, diploma and degree categories.

2.4. Data Collection Tool and Method

The author of this research is the primary source of a structured questionnaire developed after intense deliberations and panel discussions with experts using their varied professional backgrounds, experiences in similar studies and their interconnection with global professional associations, hence a decision was made to implement the questionnaire as an original document purposely for this study. This was a structured questionnaire with close-ended questions which was administered by the researchers. To assess the respondents' view on the questions and to make clarification, a pretest was done in a randomly selected district hospital whereby, nine nurses were selected to participate. The questionnaire had two parts, the first part assessed the socio-demographic characteristics that included age, gender, educational level, working area and level of experience in ICU and emergency. The second part

involved 24 multiple answer questions, which were further grouped into 7 sections namely signs and symptoms, risk factors, diagnostic measures, management, complication, nursing education and counseling. The data collection was done by professionals in the field of critical care and anesthesia after an intense three days training. There searcher administered questionnaire was estimated to take between 20 to 30 minutes. The possible maximum and minimum scores were 96 and 0 respectively. The level of knowledge was categorized by the rating scale of Asmara college of health sciences as very good (≥ 75), good (60 – 74), average (50 – 59), poor (< 50).

2.5. Statistical Analysis

Data cleaning was performed to check for accuracy, consistency and for avoidance of missed values before data entry. The cleaned data were entered in to SPSS (version 22). Descriptive analysis of the demographic characteristics was done using frequency, percentage; mean (SD), median and interquartile range (IQR) as appropriate. The difference in the level of knowledge among the different socio-demographic groups was assessed using statistical methods t-test and Kruskal Wallis one way ANOVA. The result was tested at significance level of 0.05.

3. Result

3.1. Description of Socio Demographic Characteristics of Nurses

The average median age of all nursing staff categories who participated in the study was 27 years (IQR=5 years) having a minimum of 22 and maximum 56 years of age. Age

distribution depicted the highest percentage as 59.3% in the range of 26–35 years, whereas the lowest percentage as 9.2% in the range of 36 or greater with male to female ratio of 1.3:1. The mean years of experience of those who work in ICU was found to be 4.03 with a standard deviation (SD) of ± 2.13 . The Median years of experience of the ER nurses were 3.0 with an IQR of 3.25. The majority of nurses (60%) had experience less than 5 years in ICU while 40% has 5 or more years' of experience. Distribution of nurses by clinical experience in ER showed that only 75.61% had less than 5 years' experience at ER, and 24.39% presented with 5 or more years of experience.

3.2. Description on the Knowledge of Nurses

The percentage of knowledge regarding chest pain and dyspnea as major symptom was universal (100%) in all nursing staff categories. The highest recorded value among all categories regarding the knowledge of characteristics of pain was heaviness (66.7%). Crushing was one of the most common characteristics of pain in patients with MI that was correctly responded by degree nurses (66.7%) showing significant difference with at least one of the two educational levels ($P=0.007$).

Majority of the Nurses (88.9%) were able to identify pain radiating to the arm and shoulder as a symptom of MI; the remaining symptom of pain radiation due to MI were identified as 68.5%, 33.3% and 22.2% to be towards Neck and Jaw, Back, and Posterior intra-scapular area, respectively. Among all the educational levels knowledge, regarding symptom of pain radiation to arm and shoulder was observed to be significant difference at $P=0.005$ (Table 1).

Table 1. Nurses responses regarding history and symptoms of Myocardial infarction (N=54).

Variable	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
Major symptoms of MI					
Chest pain & Dyspnea	54 (100)	9 (100)	33 (100)	12 (100)	–
Epigastric pain	20 (37.0)	1 (11.1)	14 (42.4)	5 (41.7)	0.251
Shortness of breath	40 (74.1)	6 (66.7)	24 (72.7)	10 (83.3)	0.683
Sweat (diaphoresis)	35 (64.8)	5 (55.6)	25 (75.8)	5 (41.7)	0.091
Characteristics of chest pain					
Crushing	16 (29.6)	2 (22.2)	6 (18.2)	8 (66.7)	0.007
Prolong	8 (14.8)	1 (11.1)	4 (12.1)	3 (25)	0.558
Heaviness	36 (66.7)	3 (33.3)	25 (75.8)	8 (66.7)	0.073
Tightness	26 (48.1)	2 (22.2)	17 (51.5)	7 (58.3)	0.219
Radiation of Pain					
Arm and Shoulder	48 (88.9)	5 (55.6)	32 (97.0)	11 (91.7)	0.005
Neck and jaw	37 (68.5)	5 (55.6)	22 (66.7)	10 (83.3)	0.452
Back	18 (33.3)	3 (33.3)	11 (33.3)	4 (33.3)	1.000
Posterior intra scapular	12 (22.2)	2 (22.2)	6 (18.2)	4 (33.3)	0.530

Table 2 showed that the entire staff nurse identified 12-lead ECG as diagnostic measure. Cardiac enzyme was identified by only 20.4% of the nursing staff. The study results showed a significant association between educational level, and the knowledge of cardiac enzyme ($p=0.013$),

angiography ($p=0.001$) and echocardiography ($P=0.048$). Highest percentage of nursing staff (68.5%) mentioned ST segment elevation significant at ($p=0.004$). Despite poor knowledge about cardiac enzymes as diagnostic markers for MI, few diploma nurses (15.2%), and (3%) and degree nurses,

(8.3%), and (25%) were observed to have a knowledge on CK-MB and Troponin, respectively. The result also identified that there is no significant difference in knowledge on creatinine kinase and CK-MB with the educational level.

Knowledge regarding the use of ECG as a confirmation

test for MI was 96.3% for all the nurses who responded on the time interval for examination within ten minutes of arrival, while determination of location of occlusion, detection of complication and other disease exclusion were found as 70.4%, 11%, and 38.9% respectively (Table 2).

Table 2. Responses regarding knowledge in the laboratory investigation (N=54).

Variables	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
Diagnostic measure of MI					
12-Lead-ECG	54 (100)	9 (100)	33 (100)	12 (100)	—
Cardiac enzymes	11 (20.4)	0 (0.0)	5 (15.2)	6 (50.0)	0.013
Angiography	8 (14.8)	0 (0.0)	2 (6.1)	6 (50.0)	0.001
Echocardiography	25 (46.3)	2 (22.2)	14 (42.4)	9 (75.0)	0.048
ECG interpretation of MI					
Peaked T wave...	4 (7.4)	0 (0.0)	2 (6.1)	2 (16.7)	0.328
Abnormal Q wave	0 (0)	0 (0)	0 (0)	0 (0)	—
T-wave inversion	15 (27.8)	2 (22.2)	9 (27.3)	4 (33.3)	0.833
ST-segment elevation	37 (68.5)	4 (44.4)	28 (84.9)	5 (41.7)	0.004
Cardiac enzyme used as diagnostic marker in MI					
Creatinine Kinase	4 (7.4)	0 (0.0)	2 (6.1)	2 (16.7)	0.328
CK-MB	6 (11.1)	0 (0.0)	5 (1.2)	1 (8.3)	0.703
Myoglobin	0 (0)	0 (0)	0 (0)	0 (0)	—
Troponin	4 (7.4)	0 (0.0)	1 (3.0)	3 (25.0)	0.051
Other lab investigation					
Lipid profile	35 (64.8)	4 (44.4)	20 (60.6)	11 (91.7)	0.053
Coagulation profile	9 (16.7)	0 (0.0)	3 (9.1)	6 (50.0)	0.004
Renal profile	13 (24.1)	0 (0.0)	8 (24.2)	5 (41.7)	0.093
Blood glucose	21 (38.9)	2 (22.2)	10 (30.3)	9 (75.0)	0.015
Correct about ECG					
Implement in 10 min	38 (70.4)	5 (55.6)	23 (69.7)	10 (83.3)	0.3
helps to confirm MI	52 (96.3)	9 (100)	31 (93.9)	12 (100)	1.000
Location of occlusion	6 (11.1)	1 (11.1)	5 (15.2)	0 (0)	0.397
Detect complication & exclude other disease	21 (38.9)	1 (11.1)	14 (42.4)	6 (50.0)	0.174

Majority of the nursing staff had knowledge about the risk factors of MI despite of the insignificant statistical difference ($p=0.162$) across the categories of educational level. See additional file table 2.

Regarding the knowledge on immediate management of patients with MI, there was high variation among all the nurses' categories on putting patient in emergency bed. On the cardiac monitor and intravenous (IV) line opening, diploma nurses had the highest percentage. On Oxygen administration, all the nursing staff categories had percentage above average.

Concerning the drug administration on arrival at ER, there was a level of significance ($P=0.002$) associated to the nitrate drugs. All the nurses' categories in this study appeared to have insufficient knowledge on the indication of thrombolytic therapy. A significant association was found between educational level and the knowledge of contraindications of streptokinase to bleeding disorder ($P=0.006$) and active internal bleeding ($P=0.012$). Dietary management for patients with MI was identified by majority of the nursing staff with the highest response (96.3%) and

lowest (42.6%) for low salt and fatty foods and NPO, respectively. See additional file table 3.

There were high percentages on assessment of knowledge on vital signs among the nurses where by, the blood pressure (98.1%), Oxygen saturation (98.1%), Respiratory rate (92.6%) and Heart rate (96.3%). The results for pain assessment in the general study nursing staff was found as correct in 92.6% for location and radiation, 75.9% for nature and 61.1% for duration of pain. Result of knowledge on cardiac output assessment revealed a higher result for bloodpressure (90.7%) and heart rate (68.5%) from the total nursing staff. The knowledge on the assessment of the heart rate had association with the level of education ($P=0.014$).

Knowledge on the assessment of complication observed by monitoring was found to be higher for hypotension (87%) and lower for cardiac arrest (55.6%).

Nurses' response to the type of counseling and education indicated that information on pain was higher at 85.5% and lower on NPO at 51.9%. Majority of the nursing staff concluded that physical activity & life style should be part of patients counseling (Table 4).

Table 3. Specific responses regarding knowledge assessment of disease condition and vital signs (N=54).

Variables on MI Assessment	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
Vital signs include					
blood pressure	53 (98.1)	9 (100)	32 (97)	12 (100)	1.000
Oxygen saturation	53 (98.1)	9 (100)	32 (97)	12 (100)	1.000
Respiratory rate	50 (92.6)	9 (100)	30 (90.9)	11 (91.7)	1.000
Heart rate	52 (96.3)	8 (88.9)	32 (97.0)	12 (100)	0.354
Assessment of Pain					
Location & radiation	50 (92.6)	9 (100)	29 (87.9)	12 (100)	0.457
Pain nature	41 (75.9)	5 (55.6)	25 (75.8)	11 (91.7)	0.206
Duration	33 (61.1)	4 (44.4)	19 (57.6)	10 (83.3)	0.174
Associated manifestation	19 (35.2)	4 (44.4)	8 (24.2)	7 (58.3)	0.091
Assessment of cardiac output					
Mental status	24 (44.4)	4 (44.4)	20 (60.6)	5 (41.7)	0.542
Blood pressure	49 (90.7)	7 (77.8)	30 (90.9)	12 (100)	0.182
Heart rate	37 (68.5)	5 (55.6)	20 (60.6)	12 (100)	0.014
Urine Output	32 (59.3)	3 (33.3)	22 (66.7)	7 (58.3)	0.218
Complication of MI observed on-monitor					
Arrhythmias	31 (57.4)	3 (33.3)	21 (63.6)	7 (58.3)	0.291
Hypoxia	46 (85.2)	9 (100)	27 (81.8)	10 (83.3)	0.480
Hypotension	47 (87.0)	8 (88.9)	29 (87.9)	10 (83.3)	0.855
Cardiac arrest	30 (55.6)	3 (33.3)	20 (60.6)	7 (58.3)	0.400

Table 4. Variables regarding knowledge on nursing education and counseling (N=54).

Variable for Nursing education	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
A nurse should tell to MIpatient					
NPO	28 (51.9)	3 (33.3)	19 (57.6)	6 (50.0)	0.404
Reduce activity	45 (83.3)	8 (17.8)	27 (81.8)	10 (83.3)	1.000
Bladder catheterization	31 (57.4)	4 (44.4)	23 (69.7)	4 (33.3)	0.069
Inform when there is pain	46 (85.2)	8 (88.9)	30 (90.9)	8 (66.7)	0.124
Patient's counseling should include					
Reassurance	35 (64.8)	4 (44.4)	21 (63.6)	10 (83.3)	0.203
Disease condition & self-management	43 (79.6)	5 (55.6)	27 (81.8)	11 (91.7)	0.134
Signs of complication	40 (74.1)	7 (77.8)	24 (72.7)	9 (75)	1.000
Exercise & Life style	51 (94.4)	9 (100)	31 (93.9)	11 (91.7)	1.000

Table 5. Comparison of mean knowledge scores among categories of gender, work area, total work experience and work units (N=54).

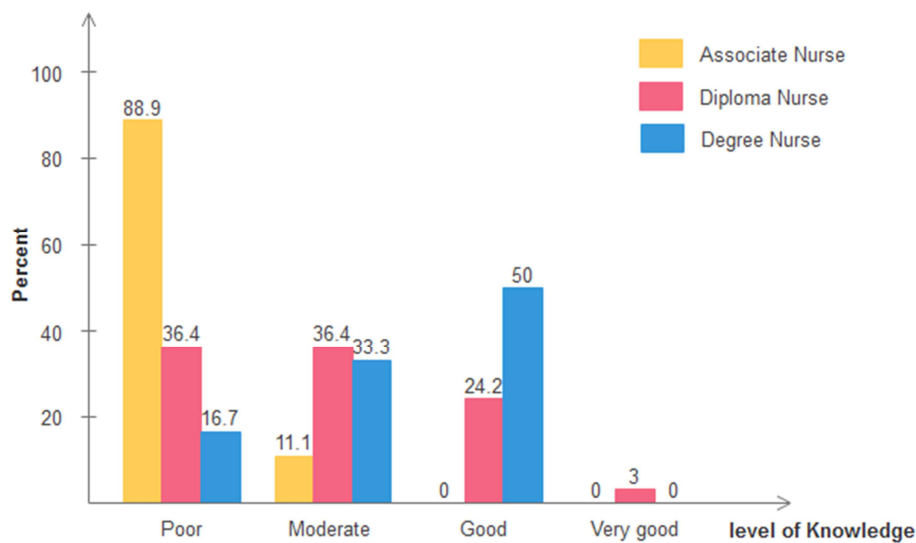
Variables	M (SD)	Diff.* (95 CI)	p-value
Gender			
Male	52.82 (11.02)	-0.17 (-6.58, 6.25)	0.959
Female	52.99 (12.37)		
Work area			
Halibet	51.91 (11.30)	-1.77 (-8.13, 4.59)	0.579
Orotta	53.68 (11.79)		
Total work experience (years)			
Less than 5	51.54 (11.56)	-2.52 (-8.84, 3.80)	0.428
Grater or equal to 5	54.05 (11.53)		
Work Unit			
ER	47.59 (10.08)	-11.50 (-17.50, -5.50)	<0.001
ICU	59.10 (9.15)		
Experience at ER (years)			
Less than 5	47.68 (10.54)	-0.73 (-7.93, 7.10)	0.908
Grater or equal to 5	48.40 (9.11)		
Experience at ICU (years)			
Less than 5	58.30 (8.5)	-2.95 (-12.32, 9.21)	0.760
Grater or equal to 5	61.25 (11.95)		

Table 6. Comparison in knowledge scores towards MI by educational level and age (N=54).

Variable	N	median (IQR)	Kruskal-Wallis p- value	Post-hoc (Mann Whitney)
Associate Nurse	9	41 (10.00)	0.002*	Associate < Diploma
Nursing Diploma	33	53 (14.00)		Diploma < Degree
Nursing Degree	12	59 (11.75)		Associate < Degree
≤ 25	17	42 (13.50)	0.014*	≤ 25 < 26 – 35
26 – 35	32	55 (17.75)		26 to 35 > ≤ 36
≥ 36	5	50 (19.50)		≤ 25 < ≥ or 36

*significant $P < 0.05$, ** Significant $P < 0.01$

In summary on the level of knowledge, 40.7% had a poor knowledge gap even though higher level of knowledge was observed in the categories the nursing staff at 1.9% figure 1.

**Figure 1.** Description on the level of knowledge of the nurses (N=54).

Level of knowledge among different educational level of staff nurses

Significantly higher level of knowledge ($P=0.001$) was observed among nurses in emergency ($M=47.59$, $SD=10.08$) as compared to those in ICU ($M=59.10$, $SD=9.15$). There was no significant knowledge difference based on the number of years of experience with in each unit.

Analysis using Kruskal Wallis indicated a significant difference in knowledge among the various educational levels ($P=0.002$). Post hoc analysis using Mann-Whitney U-test also revealed a significant difference in knowledge between associate and degree nurses ($P=0.001$), associate and diploma nurses ($P=0.003$). A significant difference ($P=0.006$) in knowledge between the age group of 25 or less and 26 to 35 years was also observed. (Table 6).

4. Discussion

The study was conducted under the main objective of assessing the level of knowledge regarding initial management of Myocardial Infarction. The study delineated that majority (57.5%) of nurses were male showing unequal distribution that males have more participation. Nurses with experiences less than 5 years were 60% and 75.61% in ICU

and ER respectively. This result reflected that, most of the nurses working in hospitals were junior nurses who recently graduated.

4.1. Knowledge on the History, Symptoms and Laboratory Investigations

The findings were good on major symptoms and moderate on radiation of pain. This explained the fact that most of the nurses witnessed the major symptoms of MI and had longstanding experiences which led to good result on the knowledge related to symptoms. The study revealed that, there was no significant statistical difference in knowledge of the symptoms between diploma and degree nurses, but a great difference was observed between associate, diploma and degree nurses. The results of this study were found to be consistent with the study done in Sudan. However, this study was inconsistent with the study done by Newens who identified that the percentage of nurses who correctly estimated the incidence of symptoms was low at 25% [9].

The overall assessment of nursing staff for the knowledge on initial recognition and laboratory investigation had poor response rate ranging from 14.8% to 46.3%. Although all nursing staff mentioned that the 12 lead ECG as a first priority of diagnostic measure, they had poor knowledge on

its interpretation and cardiac enzymes as well. A significant difference in knowledge on troponin and ST segment elevation among the educational level was identified. The researcher suggested that this significant association on the diagnostic measures along with the educational level was due to high response rate of the degree nurses. On the other hand the poor results could be due to unavailability of the materials including specific cardiac enzymes as routine procedures, unfamiliarity and limited practice of ECG among nurses. Along with ECG, Cardiac Biomarkers should be available and measured for all patients under the suspicion of MI [25]. Similar result for the focused group discussion responses were stated in India and showed the shortage of staff, lack of time and equipment prevent nurses from managing MI adequately [10].

The results of this study had inconsistency with a study done in Sudan indicating that nurses had very good knowledge related to the knowledge of ECG leads and cardiac enzymes [9]. A study done at the college of nursing, Odisha, India was also found to be inconsistent with the present study showing that majority (53%) of the total sample had good knowledge on selected therapeutic/diagnostic equipment's and having specific mean percentage score regarding the use of automated external defibrillator & ECG was 72.6% and 70.5% respectively [6]. However, study done in Sudan and India in Madurai was in line with this study [9, 28]. The knowledge result assessed from the majority of the nursing staff as regards to the risk factors was very good. This result could have been due to the nursing staff knowledge on other NCDs which share similar risks factors. This study findings were inconsistent in that, higher level of knowledge was reported among the nurses compared to a study done in Italy on the risk factors in which 15% of the nurses responded correctly [23]. A study done in Eritrea found that the comorbidity between hypertension, diabetes and acute coronary syndrome was identified as at 55.4% ($P=0.001$ [1]).

4.2. Knowledge on Early Management and Assessment of Disease Condition and Vital Signs

There was good knowledge scored on immediate management including pain and appropriate drugs to be given for MI patients. These findings were in line with a study done in Uganda [13] which stated that; majority of the participants (91.2%) had adequate knowledge about the management of pain in CCU. A study done in Sudan indicating good knowledge about MI management at (75.6%) concurred with this study findings, which included variables, differed from immediate management to CCU procedures, and the highest scores in knowledge were among immediate management (88.5%) and, pain management (81.5%) [9]. However, a study done in Sudan in 2012 was incongruent with the present study and indicated that the knowledge of nurses on beta-blockers, ASA and others was poor (26.7%) [7]. On the other hand, poor results were found as the indication of immediate thrombolytic therapy, nitrate side effects and contraindications of streptokinase. This result might have been due to low availability of the drugs, lack of

practical exposure on the administration of the drugs and poor interest to update themselves on the various resources within reach at their work place. The result was in line with the studies done in Sudan as poor knowledge was documented towards typical indications for immediate thrombolytic and moderate knowledge towards oxygen therapy [9, 17].

Explicitly good knowledge was recorded on administration of MONA, observing the patient's condition during administration and contra-indication of streptokinase ranging from (74.5% to 79.5%) [9] according to a study done in Sudan. As the knowledge on medication is one of nurses' fundamental roles, being aware of the action and side effects, contraindications and dosage of medications and counseling of the patients are important [7, 21, 30]. A study conducted in Finland and Turkey has shown that nurses in general did not satisfactorily meet their responsibility in intensive and critical care nursing [14, 29]. The study done by Mustafa and his colleagues [18] was also incongruent that the majority of nurses had poor knowledge on initial drug administration and drug of choice for reperfusion therapy.

The nursing staff were found to have very good knowledge score on vital signs that should be taken on a patient with MI. In the majority of the correct responses concerning pain assessment, the results were very good in relation to pain location, radiation at (92.6%) and its nature at (75.9%), but poor result (35.2%) were identified on the associated manifestation of pain. Although it is a mandate for a nurse especially critical care nurse to know 100% how to assess cardiac output, only 90% stated blood pressure and 68.5% mentioned heart rate as the means of assessment of cardiac output. A significant difference among educational level in knowledge on heart rate was found ($p=0.014$). Assessment of complication for cardiac arrest and arrhythmia observed through the monitors was found to be moderate and very good results for hypoxia and hypotension respectively. Hence, the researcher suggested that the deficit of monitors', negligence might influence the level of knowledge negatively. Similar study finding reported that the knowledge of nurses on vital signs was good [9]. Moreover, the study done in Uganda underpinned that majority of the participants had adequate knowledge, however, almost half of them had no knowledge on key pain assessment principles [13]. The responses of nurses regarding complications of MI was poor, especially; for pericarditis (16.7%) and arrhythmia (46.3%). The researcher suggests that this could have been due to infrequent sensitization of the topic through training and poor documentation as well as handover techniques leading to improper discussions among the staff members which affected the knowledge exchange.

Similarly, a study done by Mustafa [18] was in line with this study.

4.3. Nursing Education and Counseling on MI

The results of nurses' responses on knowledge on counseling and education of patients to reduce activity were documented as very good. Likewise, a very good knowledge

was identified regarding counseling on physical activity and life style modification, disease and self-management. There was observable good knowledge on the complication of MI. The study findings were in line with the study done in Egypt and Sudan showing good knowledge on counseling; specifically on disease and self-management as well as life-style modification [3, 9, 13]. As Johnston M, et al (1999) and Ali, (2015) stated that organized and targeting programs of counseling and education of patients by the nurses have revealed a positive outcome [12, 3]. However, the study done in Australia was inconsistent indicating that knowledge of cardiology nurses in relation to sexual and other lifestyle adjustments of post MI patients was poor [20].

In summary, on the overall level of knowledge results were categorized as poor, moderate, good and very good. Majority of the associate nurses (88.9%) had poor knowledge, most of the diploma nurses (36.4%) were between poor and moderate, and the degree nurses (50%) had good level of knowledge. Moreover, a study done in Iran and Saudi Arabia, participants from in-depth interview and focus group discussion mentioned similar results with the current study [16, 10]. A research done by Mustafa [18] identified that the population study had poor knowledge at the overall variables about acute MI. The studies indicated a poor result for half of the study population (139), and good results for only 21%. From the above study the author stated that the inability to keep up with evolving theoretical knowledge had potentially serious implications on the quality of care provided. Yet another study done by Boskand his colleagues identified that critical care nurses had inadequate knowledge regarding implantable cardiac device (ICD) [5].

4.4. Association of Knowledge with Selected Socio Demographic Characteristics of Nurses

The knowledge level of the nursing staff was found to have no significant association with gender, working area and years of experience, whereas a significant association was identified with the work units (ICU and ER) ($p < 0.001$). ICU nurses were found to have more knowledge than ER nurses and this could be as the researcher observed during her clinical time that ER is more chaotic, crowded and with more heterogeneity of cases as well as relative lack of full focus on patients care. The result also indicated that experience doesn't have measurable effect on the nurses' level of knowledge; instead, decreased knowledge was identified. This may have been attributed to the nature of work and inadequate time spent on reading which led to the decrease in the level of knowledge. The researcher argues that the ER nurses need to be equipped with knowledge through continuous on job training and workshops. These results had consistency with a study conducted by Al-Ftlawy (2014) which documented a higher knowledge on MI and its management among nurses who worked at ICU and CCU as compared to ER by showing significant association. There is no-significant relationship which was detected in age and gender variables of the nurses. Another study done in Egypt was also in line with this study which showed no significant

difference in knowledge with the years of work experience [3].

A similar study was also found to be coherent in which no significant differences on levels of competence regarding the period of work at CCU and emergency departments [18]. Studies done by Arathy S. R. [4] and Hamato [9] contradicted with this study showing that the knowledge level was higher in nursing staff who had experiences more than 5 years ($p = 0.015$). Incoherent result was found in a study done at Kufa University in Sudan with the present study showing significant relationship between level of knowledge and years of experience [2].

A higher level of knowledge on MI and its management was found in degree nurses as compared to associate nurses ($p = 0.001$). It can be argued that the difference in knowledge can be accounted to the difference in educational levels and professional achievements. But no significant difference in knowledge was detected between diploma and degree nurses. This could be reasoned as the degree nurse professionals have similar score due to less exposure of the nurses to ICU in relation to diploma. Another Study revealed the presence of significant difference in knowledge level versus qualification of nurses in which high level of knowledge and lower level of attitude among master degree nurses exhibited comparing to degree nurses. The above study showed consistency with this study [19]. The results of this study revealed a significant knowledge difference in age distribution among 25 and younger with 26 to 35, but no significant difference was found among other categories. This study was supported by similar study done by Hamato [9], which showed that majority (64.5%) of nurses who were juniors had experience of 5 years or less whereas 35.5% had experience of above 5 years. In accordance with other studies, a study done by Leyla Özdemir was also found to be congruent with this study by documenting no statistically significant differences in demographic variables [20].

5. Conclusion

Most of the nursing staff had poor level of knowledge about the initial management of acute myocardial infarction during an emergency situation. The gender and years of experience had no-significant impact on knowledge, whereas, age, working area/unit and the educational levels of the nurses had statistically significant on knowledge of the nurses. Health professionals especially the nursing staff of the tertiary hospitals need to acquire adequate knowledge and perform better practice on the initial management of MI, as the initial time is crucial and determinant to the patient survival. Moreover Policy makers should emphasis on initiation of continuous staff development programs for nurses regarding standard guidelines for management of MI at all the levels of care.

6. Limitations of Study

This study covered emergency and ICU at the two main

national referral hospitals in Asmara Eritrea, therefore the number of nurses was not representative.

Appendix

Table 6. Socio-demographic characteristics of the nurses working in ER and ICU (N=54).

Characteristics	Number (n)	Percentage (%)
Age, years (Median=27, IQR=5, Min.=22, and Max.=56)		
25 or Less	17	31.5
26 to 35	32	59.3
36 or Greater	5	9.20
Gender		
Male	31	57.4
Female	23	42.6
Nurses Educational level		
Associate Nurse	9	16.7
Nursing Diploma	33	61.1
Nursing Degree	12	22.2
Work Area		
Halibet NRH	24	44.4
Orotta NRH	30	55.6
Total Experience, years (Median=4.0, IQR=3.0)		
Less than 5	25	46.3
5 or More	29	53.7
*ICU Experience, years (n=15, Mean=4.03, SD=2.13)		
Less than 5	9	60.00
5 or More	6	40.00
*ER Experience (years) (n=41, Median=3.0, IQR=3.25)		
Less than 5	31	75.61
5 or More	10	24.39

*Working unit experience was either in Emergency or in both

Table 7. Specific responses regarding knowledge regarding risk factor (N=54).

Variable	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	p-value
Risk factor of MI					
Smoking	45 (83.3)	6 (66.7)	29 (87.9)	10 (83.3)	0.3
Hyperlipidemia & Obesity	48 (88.9)	7 (77.8)	29 (87.9)	12 (100)	0.315
DM & Hypertension	49 (90.7)	7 (77.8)	31 (93.9)	11 (91.7)	0.254
Hereditary predisposition	16 (29.6)	1 (11.1)	9 (27.3)	6 (50.0)	0.162

Table 8. Nurses responses regarding knowledge on early management (N=54).

Variables on Early management	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
Immediate management of patient					
put in emergency bed	33 (61.1)	3 (33.3)	22 (66.7)	8 (66.7)	0.204
Administration of oxygen	51 (94.4)	8 (88.9)	32 (97)	11 (91.7)	0.333
put on cardiac monitor	42 (77.8)	7 (77.8)	27 (81.8)	8 (66.7)	0.530
Insert IV line & take Lab	28 (51.9)	4 (44.4)	19 (57.6)	5 (41.7)	0.636
Pain management of MI					
Appropriate positioning	34 (63.0)	3 (33.3)	23 (69.7)	8 (66.7)	0.140
Administration of oxygen	38 (70.4)	5 (55.6)	25 (75.8)	8 (66.7)	0.495
Vasodilator drug	27 (50.0)	2 (22.2)	18 (54.5)	7 (58.3)	0.247
Appropriate pain medication	44 (81.5)	6 (66.7)	27 (81.8)	11 (91.7)	0.419
Drug given when patient arrives to ER					
Aspirin	48 (88.9)	6 (66.7)	31 (93.9)	11 (91.7)	0.079
Nitrate	49 (90.7)	5 (55.6)	32 (97)	12 (100)	0.002
Morphine	52 (96.3)	8 (88.9)	32 (97)	12 (100)	0.354
Thrombolytic	7 (13.0)	1 (11.1)	4 (12.1)	2 (16.7)	0.855
Indication for immediate thrombolytic therapy					
Chest pain within 12 hours	7 (13.0)	0 (0)	7 (21.2)	0 (0)	0.134
ST elevation >0.2chest lead	0 (0)	0 (0)	0 (0)	0 (0)	—
R&ST depression v1-v3	0 (0)	0 (0)	0 (0)	0 (0)	—
New onset LBBB	1 (1.9)	0 (0)	1 (3)	0 (0)	1.000
Other drugs which might be given					
Beta blocker	24 (44.4)	3 (33.3)	16 (48.5)	5 (41.7)	0.771

Variables on Early management	Total (N=54) (%)	Associate Nurse (n=9) (%)	Diploma Nurse (n=33) (%)	Degree Nurse (n=12) (%)	P-value
ACE inhibitors	16 (29.6)	2 (22.2)	12 (36.4)	2 (16.7)	0.413
Anti-arrhythmic	7 (13.0)	1 (11.1)	3 (9.1)	3 (25)	0.382
Anti-coagulant	23 (42.6)	1 (11.1)	16 (48.5)	6 (50)	0.129
Nitrate side effects					
Flushing	1 (1.9)	0 (0)	0 (0)	1 (8.3)	0.389
Tachycardia	9 (16.7)	1 (11.1)	4 (12.1)	4 (33.3)	0.258
Postural hypotension	24 (44.4)	2 (22.2)	16 (48.5)	6 (50)	0.427
Headache	19 (35.2)	1 (11.1)	15 (45.5)	3 (25)	0.129
Contraindication of streptokinase include					
Bleeding disorder	22 (40.7)	0 (0)	14 (42.4)	8 (66.7)	0.006
Major surgery	14 (25.9)	0 (0)	11 (33.3)	3 (25)	0.147
Active internal bleeding	21 (38.9)	0 (0)	14 (42.4)	7 (58.3)	0.012
Previous hemorrhagic stroke	8 (14.8)	0 (0)	5 (15.2)	3 (25)	0.409
Diet give to MI Patient					
Keep NPO initially	23 (42.6)	3 (33.3)	15 (45.5)	5 (41.7)	0.925
Small & frequent	43 (79.6)	7 (77.8)	25 (75.8)	11 (91.7)	0.564
Low salt & low fat food	52 (96.3)	9 (100)	32 (97)	11 (91.7)	0.631
High fiber food	36 (66.7)	5 (55.6)	22 (66.7)	9 (75)	0.604

Abbreviations

ANOVA: Analysis of Variance; CAD: Coronary artery Disease; CCU: Critical Care Unit; CK-MB: Creatine Kinase Myocardial Band; ECG: Electrocardiography; ER: Emergency Room; HNRH: Halibet National Referral Hospital; ICU: Intensive Care Unit; MI: Myocardial Infarction, MONA: Morphine, Oxygen, Nitrates, and Aspirin; NCDs: Non-Communicable Diseases; ONRTH: Orotta National Referral Teaching Hospital; SD: Standard Deviation

Declaration

I, the principal author, hereby declare that I am the sole author of this dissertation entitled, “Knowledge on the Initial Management of Myocardial Infarction among Emergency and Intensive Care Nurses; A cross sectional study in Orotta & Halibet National Referral Hospitals, Asmara, Eritrea.” This is my original work and the dissertation or any part thereof has not been submitted for the award of a degree to any other university or institution.

Funding

Funding was given from the National Higher Education and Research Institute (NHERI) and Ministry of Finance Eritrea (MOFE) as an incentive for the fulfillment of the MSc degree. Their role was only on facilitation.

Author's Contribution

SA: Study conception and design of study, participated in designing questionnaire, acquisition of data, analysis and interpretation of data, drafting and submission of manuscript; RA, SS: participated in designing and coordination of the study, participated in designing questionnaire, revising the manuscript critically for important intellectual content; GG, LLS: participated in designing, drafting and revising the manuscript

critically for important intellectual content and participated in designing questionnaire EH: participated in designing questionnaire, analysis and interpretation of the data, drafting of manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

A formal research study approval was obtained from Ministry of Health Ethical and scientific Committee of the Asmara College of health Sciences as well as that of the Ministry of Health. A written paper was provided for getting permission for data collection to Health Facility Management Division and the two studies areas Hospital Directors. Written consent was used for the participant's willingness and all the information provided was kept confidential. Consent from the nurses was obtained verbally and in written form before administration of the structured questionnaire.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on a reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations

Acknowledgements

The authors would like to thank the National

Commission for Higher Education (NCHE) for funding the research, the data collectors, study participants, hospital directors, hospital staff, family, friends for their valued cooperation and support.

References

- [1] Adgoy, E. T., Seyoum, Y., Berhe, A., tewolde, Y., & Kibreab, F. (2017). prevalence, preventing complaints, RiskFactors and Comorbidity of AcuteCoronary Syndrome at Orotta National Referral Hospital Intensive Care Unit Eritrea: Retrospective Study. *Science Journal of Public Health*, 5 (6), 457.
- [2] Al-Ftlawy, & D. M. H. (2014). Determination of nurses' Knowledge toward care provided to patients with acute myocardial infarction. *Kufa Journal of Nursing Science*, 2 (2).
- [3] Ali, N. S., Youssef, W., Mohamed, A., & Hussein, A. (2015). Nurses' knowledgwe and practive regarding implantable cardiac devices in Egypt. *British Journal for Cardiac Nursing*, 10 (1), 34-40.
- [4] Arathy. s. r. (2011). study to asses the Knowledge and practice amongcardiacnurses about patient safety after cardiac catheterization.
- [5] Bosk, E. A., Veinot, T., & Iwashyna, T. J. (2011). Which patient and where, a qqualitative study of patient transfer from community hospitals. *Medical care* 2011, 49 (6), 592.
- [6] Das, S., Mala Pradhan, R., & Patel, T. (2010). an integrated review of Nurses' Knowledge on Therapeutic &Diagnostic Equipment with a view to develop guidelines.
- [7] Eckman, T., Haley, R., Bradley, E., Albert, M., Kolm, P., & Jurkowitz, C. (2012). Direcr care Nurses' Knowledge in Acute Myocardial Infarction Treatment. *Journal for Nurses in Professional Development*, 28 (5), 229-232.
- [8] Feroze, M., Afzal, M., Sarwar, H., Galani, A., & Afshan, S. (2017). Knowledge and practice of Registered Nurses about Patient Safety after Cardiac Catheterization in Punjab Institute of Cardiology Hospital in Lahore, Pakistan. *International Journal of Musculoskeletal Pain prevantion*, 2 (2), 233-238.
- [9] Hamato, T. (2015). Nurses' knowledge and practice regarding Nursing care for Myocardial Infarction Patient in the first 24 hours in Governmental Hospital in Khartoum state.
- [10] Jaralnabi, A. A., Atawi, S., Sagiron, W. I., Alasmari, N., & Alasmari, H. (2017). Effect of Education program on Nurses' Knowledge, Atitudeand Intentions to ward Myocardial Infarction prevention and Treatment. *American Journal of Environmental and Occupational Health*, 2 (2), 7-14.
- [11] Jeremias, A., & Browm, D. L. (2010). *CardiacIntensive acer Second Edition*.
- [12] Johnston, M., Foulkes, J., Johnston, D. W., Pollard, B., & Gudmundsdottir, H. (1999). Impact on Patients and partners of in patient and extended cardac counseling and rehabilitation: a controlled trial. *Psychosomatic Medicine*, 61 (2), 225-233.
- [13] Kizza, I. (2012). Nurses' Knowledge and practicees Related to Pain Assessment in Critically ill Patient at Mulago Hospital, Uganda Muhimbili University of Heath and Allied Sciences.
- [14] Lakanmaa, R. L., Suominen, T., Perttila, J., Puukka, P., & Leino-Kilpi, H. (2012). Competence requirements in intensive and critical care nursing. *Intensive and Critical Care Nursing*, 28 (6), 329-336.
- [15] Maddox, T. M., Stanislawski, M. A., Grunwald, G. K., Bradley, S. M., Ho, P. M., Tsai, T. T., & Magid, D. J. (2014). Nonobstructive coronary artery disease and risk of myocardial infarction. *Jama*, 312 (17), 1754-1763.
- [16] Mahmoudi, H., Mahmoudi, E., & Ebadi, A. (2013). Barriers to nursing care in emergency ward. *Iraninan journal of nursing and midwifery research*, 18 (2), 145.
- [17] Mustafa, H. E., & Elfaki, B. A. (2016). Determination nurses' knowlege about initial drugs used duringemergency managment of acute myocardial infarction. *Journal of Nursing Educatio and Practice*, 7 (5), 62.
- [18] Mustafa, H. E., Nimeiri, M., Bolad, A., & Khalil, S. (2013a). Assessment of Nurses's competences during Emergency Managment of Patient with acute Myocardial Infarction at critical care units and emergency department at public teaching Hospitals in Kharto Stat.
- [19] Mustafa, H. E., Khalil, S. E., EL nimerir, M. K., & Bolad, A. (2013b). Assessment of Nurses competency during emergency Managment of patient with Acute Myocardial Infarction. *Al Neelain Medical Journal*, 1858-627.
- [20] Özdemir, L., & Akdemir, N. (2008). Nurses' Knowledge and practice involving patient resumig sexual activity following myocardial infarction: implication for traning. *Australian Journal of Advanced Nursing*, 26 (1), 42.
- [21] Schwartz, B. G., & Kloner, R. A. (2010). Drug interactions with phosphodiesterase-5 inhibitors used for the treatment of erectile dysfunction or pulmonary hypertantion. *Circulation*, 122 (1), 88-95. doi: DOI: 10.1161/CIRCULATIONAHA.110.944603.
- [22] Seyoum, Y., & Leake, N. (2006). Clinical features of acute myocardial infarction: A report from Halibet Referral Hospital in Eritrea. *Journal of Eritrean Medical Association*, 1 (1).
- [23] Steffenino, G., Galliano, E., & Rotta, M. (2005). Risk factors, life habits and personal beliefs of nurse and nurse-students about cardiovascularprevention. *Italian heart journal. supplement: official journal of the italian Federation of cardiology*, 6 (3), 172-177.
- [24] UN. (2014). *Health Millennium Development Goals report abridged version innovations driving health median Eritrea*.
- [25] Weiss, E. S., Chang, D. D., Joyee, D. L., Nwakanma, L. U., & Yuh, D. D. (2008). Optimal timig of coronary artery bypass after myocardial infarction: a review of California discharge data. *The Journal of thoracic and cardiovascular surgery*, 135 (3), 503-511.
- [26] Organization, 2. H. (2007). *Prevantion of cardiovascular disease: guidelines for assessment and managment of cardiovascular risk*.
- [27] WHO. (2014). *Selected Causes of Death CoronaryHeart Disease age- Ajusted Death Rate*. Available at <http://www.Worldlifeexpectancy.com>.
- [28] Xavier, B. (2013). Effectiveness of self Instructional Module regarding Emergency Managment of patient with Myocardial Infarctionon Knowledge among Nursing staff. *IORS Journal of Nursing and Health Science*, 2 (6), 14-19.

- [29] Yava, A., Cicek, H., Tosun, N., Ozcan, C., Yildiz, D., & Dizer, B. (2013). Knowledge and Attitudes of Nurses about Pain Management in Turkey. *International Journal of Caring Sciences*, 6 (3).
- [30] Ziba, F. N., & Shirazi, F. B. (2017). Effect of Nurses' Awareness on Myocardial Infarction Pain Management. *Journal of Critical care Nursing*, 10 (1).