



Journal of Acute Disease

Original Article



doi: 10.4103/2221-6189.374310

jadweb.org

General awareness of symptoms of myocardial infarction and the need for urgent treatment: A cross-sectional, street survey in Chennai, Tamil Nadu

Thirumurugan E^{1,2}✉, Gomathi K², Swathy P², Syed Ali Afrin², Ponduri Lakshmi Alekhya², Jishnu B², Banashree Das²

¹Srinivas University, Mangalore, Karnataka, India

²Faculty of Allied Health Science, DR. M.G.R. Educational and Research Institute, ACS Medical College, Chennai, Tamil Nadu, India

ABSTRACT

Objective: To investigate the golden-time-awareness of and the necessary actions in response to acute myocardial infarction among the general public.

Methods: This study was conducted with the use of a descriptive research design and convenience sampling. A sample of 800 subjects, using self-structured knowledge questionnaires, was selected for data collection and analysis. The study was conducted at Dr. M.G.R. Educational and Research Institute, India, from February to November 2022. Awareness of myocardial infarction symptoms and intervention timeline (the golden time) was investigated. A multivariate logistic regression analysis was performed to identify the demographic factors affecting the recognition of the golden time of acute myocardial infarction.

Results: A total of 800 subjects were included. Among the subjects, 367 (45.8%) were male, 433 (54.2%) were female, and 443 (55.3%) participants failed to recognize the golden time. Our multivariate logistic regression analysis showed that people with a bachelor's degree ($OR=0.41$, 95% CI : 0.23-0.74, $P=0.03$) and a high school level diploma ($OR=0.55$, 95% CI : 0.31-0.97, $P=0.03$) are more likely to know about myocardial infarction (golden time) than illiterate people. Additionally, people who are employed ($OR=0.59$, 95% CI : 0.41-0.85, $P=0.05$) are more likely to know about myocardial infarction (golden time) than those who are not.

Conclusions: The majority of people in the awareness group realize that taking myocardial infarction patients to the hospital would be the best course of action. The unawareness of the ideal treatment window for myocardial infarction may cause a delay in seeking medical attention, which can lead to an increase in mortality and morbidity.

KEYWORDS: Heart attack; Intervention timeline; Symptoms; Treatment; Myocardial infarction; Percutaneous coronary intervention

1. Introduction

Primary percutaneous coronary intervention (PCI) is the preferred choice of treatment for ST-segment-elevation myocardial

Significance

Lack of recognition of the golden time can lead to delayed treatment of myocardial infarction, which can increase mortality and morbidity. To reduce deaths and cardiac arrests, early recognition of myocardial symptoms and prompt treatment-seeking behaviors should be promoted. The majority of people in this study (awareness group) realized that taking myocardial infarction patients to the hospital would be the best course of action.

✉To whom correspondence may be addressed. E-mail: thiruahs1002@gmail.com, thirumurugan.cct@drmgrdu.ac.in

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

©2022 Journal of Acute Disease Produced by Wolters Kluwer-Medknow.

How to cite this article: Thirumurugan, Gomathi, Swathy, Syed Ali A, Ponduri Lakshmi A, Jishnu, et al. General awareness of symptoms of myocardial infarction and the need for urgent treatment: A cross-sectional, street survey in Chennai, Tamil Nadu. J Acute Dis 2023; 12(2): 51-56.

Article history: Received 6 December 2022; Revision 28 February 2023; Accepted 8 April 2023; Available online 26 April 2023

infarction[1]. Treatment delays can be used to evaluate the quality of care and can negatively impact patient outcomes[2]. The treatment delay is defined as the time from the onset of symptoms to the first medical contact; the prehospital system delay is defined as the time from the first medical contact to the arrival at a PCI-ready hospital; and the in-hospital delay is defined as the time between arrival at a PCI-ready hospital and balloon inflation[3,4].

The early recognition of symptoms and prompt medical attention are essential to prevent adverse clinical outcomes in patients with myocardial infarction (MI)[5]. Percutaneous transluminal coronary angioplasty and stent placement within 90 min of the onset of pain are the optimal treatments for MI[4]. However, inadequate awareness of MI symptoms may lead to treatment delays and adverse health events. The reasons causing treatment delays include patients' lack of knowledge of MI symptoms, denial, fear, or unwarranted trust in self-management. Lack of awareness of symptoms can lead to a patient's delay in summoning emergency services and affect treatment options like percutaneous angioplasty[6,7].

In spite of significant awareness research on MI, many issues about MI in the general population remain unsettled, including knowledge of early symptoms and appropriate responses to acute myocardial infarction (AMI). We carried out this study to explore the golden-time-awareness of and the necessary actions in response to AMI among the general public.

2. Patients and methods

2.1. Study setting and design

The study was conducted at the Dr. M.G.R. Educational and Research Institute, India, from February to November, 2022, using a quantitative approach and a descriptive research design.

2.2. Ethical approval

The study plan was submitted to the Institutional Ethics Committee, and ethical clearance was granted (No: 472/2022/IEC/ACSMCH). During the data collection phase, the subjects were asked to sign an informed consent form. The confidentiality and anonymity of the respondents were assured.

2.3. Recruitment

The population of this cross-sectional research consists of people aged 18 years and over living in India. The data were collected from February 2022 by undertaking a street survey among the residents of Chennai, Tamil Nadu, India. Different locations were chosen in the city (markets, malls, shopping streets, etc.) based on the presence of a relatively large number of passers-by. However, we avoided places where people would rush, such as train or bus stations. We

selected different places in different parts of the city so that there would be a variety of socioeconomic backgrounds among the place settings. The survey team collected data in each location using paper surveys. All of the staffs who collected data were previously trained in how to administer the survey in a standardized way (for example, asking questions in a literal way, and making sure to know which questions needed to be asked openly). We asked a random passer-by to participate in the study, namely each third individual, in order to avoid including people from the same group (such as husband and wife).

All adults who had provided their informed consent and were at least 18 years old were included in this study. Adults aged <18 years, those who have not given consent, and those who were not responded to the questionnaire were excluded from the study. The study also excluded patients with a history of intellectual disability, or previous percutaneous transluminal coronary angioplasty, or coronary artery bypass graft surgery.

The number of respondents in our study was 801. One questionnaire was stopped early, which made it unfit for use in the analysis. The final sample of total usable questionnaires was 800 (Figure 1).

2.4. Survey

Data were collected in the interview method, using self-structured questions for each subject, including an examination of socio-demographic data and a question on early symptoms and appropriate responses to AMI. A total of 24 questions were asked for each subject.

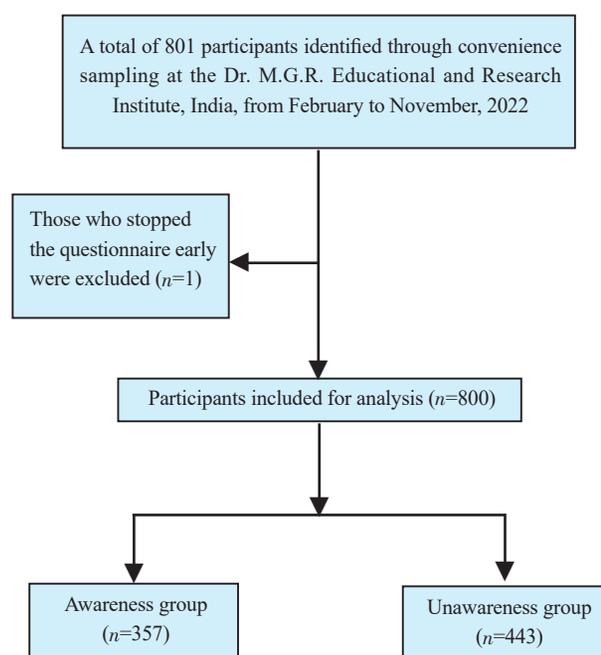


Figure 1. The study flowchart.

2.4.1. Awareness of myocardial infarction symptoms

An individual's awareness of MI was assessed by their responses to the question: "Which of the following are symptoms of a heart attack?" (1) sudden pain or discomfort in the jaw, neck, or back; (2) weakness or dizziness; (3) sudden pain or discomfort in the chest; (4) sudden disturbance of vision in one or both eyes; (5) sudden pain or discomfort in the arms or shoulders; and (6) sudden shortness of breath.

2.4.2. Response to intervention timeline (golden time) for myocardial infarction

In response to the question, the level of awareness of each participant about the intervention timeline, the golden time of MI was assessed: "Are you aware of the golden time to reach a hospital for myocardial infarction treatment?" (1) <90 mins; (2) 90-180 mins; (3) >180 mins; (4) Do not know.

Based on the response to the awareness of the golden time of MI, the participants were divided into two exclusive subgroups: the unawareness group, in which the participants indicated that the golden time is 90-180 mins, >180 mins and do not know, and the awareness group, in which the participants identified the golden time as <90 mins.

2.5. Primary and secondary outcomes

Lack of recognition of the golden time by lay people can lead to delayed treatment of an MI, which can increase mortality and morbidity. The primary outcome includes recognition of the golden time. The secondary outcome includes early symptoms recognition and prompt treatment-seeking behavior.

2.6. Statistical analysis

Statistical analysis was carried out using the SPSS 20.0 software. Among the nominal variables, the number and percentage were presented. A Chi-square test was used to compare the nominal variables between groups. A multivariate logistic regression analysis was performed to identify the factors affecting the probability of belonging to the aware or unaware groups. A significance level of $P < 0.05$ was used. According to the 2011 data from the office of Registrar General & Census Commissioner, India, the population living in India was 1210854977[8]. Accordingly, we calculated the sample size using the OpenEpi Version 3 Program based on unknown prevalence to be 384 at 50% prevalence and 95% confidence interval. The draft questionnaire was presented to an expert panel of five academic staffs from the discipline of clinical cardiology. The panel determined that the questionnaire was valid and reliable. A pilot study was conducted to determine the consistency and reliability of the questionnaire. The results were satisfactory, with an alpha value of 0.68. To ensure accuracy of the findings of the main study, participants of the pilot study were excluded.

3. Results

3.1. Socio-demographic parameters of the study population

Regarding demographic characteristics, 45.8% were men and 54.2% were women, and the majority (53.2%) of them were in the age group of 20-29 years, followed by 12.7% in the age group of 30-39 years, 24.3% in the age group of 40-49 years, 7.3% in the age group of 50-59 years, and 2.5% in the age group of more than 60 years. The mean age of the participants was (33.3±12.0) years.

A majority of participants, 409 (51.2%), had bachelor's degrees as their highest educational level, followed by 37.0% from high school and 11.8% illiterate. In our study, 336 were employed (42.0%) and 464 were unemployed (58.0%). Among all participants, 5.8% were current smokers, 9.6% were current drinkers, and 15.9% had hypertension, as shown in Table 1.

Sources of MI information were obtained mostly from the following: TV (142, 17.8%), internet (85, 10.7%), books (141, 17.6%), and friends & others (161, 20.1%). Less information was obtained through smart device applications such as social media (19, 2.3%) and seminars (25, 3.1%) and by health care professionals (62, 7.8%). While the least information was obtained through posters/leaflets (4, 0.5%), as shown in Supplementary Table 1.

3.2. Awareness of myocardial infarction symptoms

Of the total participants, 55.4% of the participants failed to recognize the golden time, while 44.6% recognized it, as shown in Table 2.

We compared the six symptoms of MI and found that the awareness group showed slightly higher awareness of the symptoms of "shortness of breath, weakness and dizziness" than the unawareness group, but the unawareness group showed slightly higher awareness of the other two symptoms relative to the awareness group (discomfort in the jaw, disturbance of vision) with no statistical difference ($P > 0.05$). Furthermore, both groups had a similar awareness of the symptoms of "discomfort in the chest" and "discomfort in the arms".

3.3. Treatment-seeking behavior at the onset of myocardial infarction

The majority of participants (59.1%) in the awareness group identified the appropriate course of action as taking them to the hospital, compared to the unawareness group, with no statistical difference ($P > 0.05$). However, other actions (8.1%) were the second most typical course of action compared to the unawareness group. Furthermore, nearly <30% of participants in both groups identified calling an ambulance as an appropriate response (Table 3).

Table 1. Sociodemographic variables of the study population (n, %).

Variables	Total (n=800)	Awareness group (n=357)	Unawareness group (n=443)	χ^2	P
Sex					
Male	367 (45.8%)	139 (39.0%)	228 (51.4%)	32.6	<0.05
Female	433 (54.2%)	218 (61.0%)	215 (48.6%)	-	-
Age, years					
20-29	426 (53.2%)	224 (62.8%)	202 (45.6%)	12.5	<0.05
30-39	101 (12.7%)	27 (7.5%)	74 (16.7%)	-	-
40-49	195 (24.3%)	81 (22.6%)	114 (25.8%)	-	-
50-59	58 (7.3%)	21 (5.9%)	37 (8.3%)	-	-
≥ 60	20 (2.5%)	4 (1.2%)	16 (3.6%)	-	-
Marital status					
Married	405 (50.6%)	143 (40.0%)	262 (59.1%)	21.5	<0.05
Unmarried	395 (49.4%)	214 (60.0%)	181 (40.9%)	-	-
Educational status					
Bachelor's degrees	409 (51.2%)	205 (57.5%)	204 (46.0%)	28.8	<0.05
High School	296 (37.0%)	129 (36.1%)	167 (37.7%)	-	-
Illiterate	95 (11.8%)	23 (6.4%)	72 (16.3%)	-	-
Occupational status					
Employed	336 (42.0%)	110 (31.0%)	226 (51.0%)	33.1	<0.05
Unemployed	464 (58.0%)	247 (69.0%)	217 (49.0%)	-	-
Hypertension					
Yes	127 (15.9%)	46 (12.8%)	81 (18.3%)	4.31	0.03
No	673 (84.1%)	311 (87.2%)	362 (81.7%)	-	-
Smoking					
Yes	47 (5.8%)	9 (2.5%)	38 (8.6%)	13.11	<0.05
No	753 (94.2%)	348 (97.5%)	405 (91.4%)	-	-
Alcoholic					
Yes	77 (9.6%)	17 (4.8%)	60 (13.5%)	17.52	<0.05
No	723 (90.4%)	340 (95.2%)	383 (86.5%)	-	-

Smoking: those who used cigarettes in the past 30 days with a frequency of 3-5 cigarettes per day. Alcoholic: those who used alcohol with a frequency of 5 or more drinks at least once in the past two weeks.

Table 2. Awareness of myocardial infarction symptoms (n, %).

Category	Total (n=800)	Awareness group (n=357)	Unawareness group (n=443)	χ^2	P
Sudden pain or discomfort in the jaw, neck, or back	513 (64.1%)	226 (63.3%)	287 (64.7%)	0.188	0.66
Weakness or dizziness	459 (57.3%)	205 (57.4%)	254 (57.3%)	0.001	0.98
Discomfort in the chest	585 (73.1%)	261 (73.1%)	324 (73.1%)	0.000	0.99
Disturbance of vision	263 (32.8%)	117 (32.7%)	146 (32.9%)	0.003	0.95
Discomfort in arms	518 (64.7%)	231 (64.7%)	287 (64.7%)	0.001	0.98
Shortness of breath	615 (76.8%)	275 (77.0%)	340 (76.7%)	0.009	0.92

Table 3. Treatment-seeking behaviors at the onset of myocardial infarction (n, %).

Category	Total (n=800)	Awareness group (n=357)	Unawareness group (n=443)	χ^2	P
Take them to hospital	467 (58.3%)	211 (59.1%)	256 (57.7%)	1.044	0.984
Call his/her doctors	35 (4.3%)	14 (3.9%)	21 (4.7%)		
Call an ambulance	216 (27%)	94 (26.3%)	122 (27.5%)		
Call police	3 (0.3%)	1 (0.28%)	2 (0.4%)		
Contact their family	9 (1.1%)	4 (1.1%)	5 (1.1%)		
Other actions	61 (7.6%)	29 (8.1%)	31 (6.9%)		
Do not know	10 (1.2%)	4 (1.1%)	6 (1.35%)		

3.4. Predictors of awareness of golden time to reach hospital for treatment of acute myocardial infarction

We used multivariate logistic regression to determine which factors affect whether or not people know about MI (golden time). The results showed that that people with a bachelor's degree ($OR=0.41$,

95% CI : 0.23-0.74, $P=0.03$) and high school level diploma ($OR=0.55$, 95% CI : 0.31-0.97, $P=0.03$) are more likely to know about MI (golden time) than illiterate people. Additionally, people who are employed ($OR=0.59$, 95% CI : 0.41-0.85, $P=0.05$) are more likely to know about MI (golden time) than those who are not (Table 4).

4. Discussion

According to Moser *et al.*, a few key barriers that raise the rate of mortality and morbidity of MI include delays in transportation to the hospital, delays in intervention after arriving at the hospital, and long time taken in seeking medical care[9]. The current research was conducted among the lay public in Chennai, Tamil Nadu, India to assess their awareness of the golden time for the treatment of and action taken in response to the signs and symptoms of AMI.

In the current study, shortness of breath was the most common symptom of MI recognized by the respondents in both groups. These findings are not consistent with previous research[10-13]. In contrast, a study conducted in South Korea found that the most commonly reported heart attack symptom was chest pain, whereas the least commonly reported symptom was discomfort in the arms or shoulders[14]. Furthermore, nearly 70% of the respondents in our survey identified chest pain as a MI symptom in both groups.

The current study found that less than half of the respondents were unaware of the appropriate action for someone suffering from MI, which is calling an ambulance. These findings are not consistent with previous research[15]. The low awareness of the golden time for the treatment of MI in the current study might be responsible for the low recognition of the appropriate actions to be taken. Nonetheless, knowing the appropriate actions to take in the event of a MI is crucial, but it is insufficient to eliminate the prehospital delay.

Table 4. Multivariate logistic regression analysis of predictors on the golden time for acute myocardial infarction.

Variables	OR (95% CI)	P
Sex		
Male	Reference	-
Female	0.76 (0.55, 1.07)	0.11
Age, years		
20-29	0.76 (0.21, 2.79)	0.68
30-39	1.06 (0.30, 3.73)	0.91
40-49	0.46 (1.41, 1.52)	0.20
50-59	0.44 (0.12, 1.59)	0.21
≥ 60	Reference	-
Marital status		
Married	0.57 (0.31, 1.04)	0.06
Unmarried	Reference	-
Educational status		
Graduate	0.41 (0.23, 0.74)	0.03
High School	0.55 (0.31, 0.97)	0.03
Illiterate	Reference	-
Occupational status		
Employed	0.59 (0.41, 0.85)	0.05
Unemployed	Reference	-
Hypertension		
Yes	1.01 (0.65, 1.57)	0.94
No	Reference	-
Smoking		
Yes	0.64 (0.24, 1.73)	0.38
No	Reference	-
Alcoholic		
Yes	0.62 (0.29, 1.32)	0.21
No	Reference	-

Respondents who are unaware of the golden period for MI treatment may take longer to seek medical attention.

Doddipalli *et al.* reported that inadequate awareness and prolonged time in recognizing symptoms were the main causes of prolonged total ischemic time. The mean total ischemic time (TIT) was significantly higher among expired patients[(8.0±3.6) h vs. (6.2±2.8) h; $P<0.05$] than alive patients[16]. A study by Chandrasekhar *et al.* in an Australian population reported prolonged TIT (>240 min) for more than one-third of patients with ST-segment-elevation MI. They also noted TIT as an independent risk factor for major adverse cardiovascular events[17]. In our study, of the total participants, 55.3% failed to recognize the golden time, while 44.7% recognized it. The age group of 30-39 years and participants with hypertension were factors influencing the recognition of the golden time of AMI.

The current study's findings are limited in their generalizability due to the convenient sampling method. Furthermore, the findings originated from one place in India and cannot be generalized to the entire Indian population. Additionally, the current study used a self-report questionnaire with closed-ended questions. This type of question may limit participants' ability to adequately explain their experience with the golden time and increase self-report bias.

The current study targeted the general population, not patients with MI, to investigate the awareness of the golden time for AMI and found the factors affecting such awareness. The majority of people in the awareness group realized that taking MI patients to the hospital would be the best course of action. Those who are unaware of the ideal treatment window for MI may cause a delay in seeking medical attention, which can lead to an increase in mortality and morbidity. Educational interventions can be developed to increase public recognition of this research, so that people are more likely to seek medical attention if they experience symptoms or signs of MI.

Conflict of interest statement

The authors report no conflict of interest.

Funding

This study received no extramural funding.

Acknowledgements

Researchers thankfully acknowledge Dr. Kalpana Devi, Principal, and Dr. Kalavathy Victor, Director of Allied Health Science of Dr. M.G.R. Educational and Research Institute for active guidance.

Authors' contributions

ET contributed to the project design, data interpretation, drafting the article, revising it critically, and final approval of the version to be published; GK, SP, and SAA contributed by project awareness regarding the golden time among general population design, data interpretation, statistical analysis, article preparing, and submission; PLA, JB, and BD contributed by the collection of data, and data interpretation. The manuscript has been read and approved by all the authors that the requirements for authorship have been met, and each author believes that the manuscript represents honest work.

References

- [1] Tomassini F, Tarantino F, Cerrato E, Quadri G, Rolfo C, Varbella F. Choice of vascular access in primary PCI. *Minerva Cardioangiologica* 2018; **66**(4): 400-410.
- [2] Terkelsen CJ, Lassen JF. Treatment delays in ST elevation myocardial infarction. *BMJ* 2008; **336**(7641): 401-402.
- [3] Erol MK, Kayıkçıoğlu M, Kılıçkap M, Güler A, Öztürk Ö, Tuncay B, et al. Time delays in each step from symptom onset to treatment in acute myocardial infarction: Results from a nation-wide TURKMI registry. *Anatol J Cardiol* 2021; **25**(5): 294-303.
- [4] Park J, Choi KH, Lee JM, Kim HK, Hwang D, Rhee TM, et al. Prognostic implications of door-to-balloon time and onset-to-door time on mortality in patients with ST-segment-elevation myocardial infarction treated with primary percutaneous coronary intervention. *J Am Heart Assoc* 2019; **8**(9): e012188.
- [5] Lichtman JH, Leifheit-Limson EC, Watanabe E, Allen NB, Garavalia B, Garavalia LS, et al. Symptom recognition and healthcare experiences of young women with acute myocardial infarction. *Circ Cardiovasc Qual Outcomes* 2015; **8**(2 Suppl 1): S31-S38.
- [6] Abdo Ahmed AA, Mohammed Al-Shami A, Jamshed S, Fata Nahas AR, Mohamed Ibrahim MI. Public awareness of and action towards heart attack symptoms: An exploratory study. *Int J Environ Res Public Health* 2020; **17**(23): 8982.
- [7] Meisel SR, Kleiner-Shochat M, Abu-Fanne R, Frimerman A, Danon A, Minha S, et al. Direct admission of patients with ST-segment-elevation myocardial infarction to the catheterization laboratory shortens pain-to-balloon and door-to-balloon time intervals but only the pain-to-balloon interval impacts short- and long-term mortality. *J Am Heart Assoc* 2020; **10**(1): e018343.
- [8] The Office of Registrar General & Census Commissioner, Ministry of Home Affairs, Government of India. A-1 number of villages, towns, households, population and area. [Online] Available from: https://censusindia.gov.in/nada/index.php/catalog/42526/download/46152/A-1_NO_OF_VILLAGES_TOWNS_HOUSEHOLDS_POPULATION_AND_AREA.xlsx [Accessed on March 8, 2023].
- [9] Moser DK, Kimble LP, Alberts MJ, Alonzo A, Croft JB, Dracup K, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: A scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council. *Circulation* 2006; **114**(2): 168-182.
- [10] Cytryn KN, Yoskowitz NA, Cimino JJ, Patel VL. Lay public's knowledge and decisions in response to symptoms of acute myocardial infarction. *Adv Health Sci Educ Theory Pract* 2009; **14**(1): 43-59.
- [11] Intas G, Tsolakoglou J, Stergiannis P, Chalari E, Eleni C, Fildissis G. Do Greek citizens have minimum knowledge about heart attack? A survey. *Health Sci J* 2015; **9**(5): 1-6.
- [12] Kopec G, Sobien B, Podolec M, Dziedzic H, Zarzecka J, Loster B, et al. Knowledge of a patient-dependant phase of acute myocardial infarction in Polish adults: The role of physician's advice. *Eur J Public Health* 2011; **21**(5): 603-608.
- [13] Mukattash TL, Shara M, Jarab AS, Al-Azzam SI, Almaaytah A, Al Hamarneh YN. Public knowledge and awareness of cardiovascular disease and its risk factors: A cross-sectional study of 1000 Jordanians. *Int J Pharm Pract* 2012; **20**(6): 367-376.
- [14] Kim HS, Lee H, Kim K, Park HK, Park KS, Kang GW, et al. The general public's awareness of early symptoms of and emergency responses to acute myocardial infarction and related factors in South Korea: A national public telephone survey. *J Epidemiol* 2016; **26**(5): 233-241.
- [15] Fang J, Gillespie C, Keenan NL, Greenlund KJ. Awareness of heart attack symptoms among US adults in 2007, and changes in awareness from 2001 to 2007. *Future Cardiol* 2011; **7**(3): 311-320.
- [16] Doddipalli SR, Rajasekhar D, Vanajakshamma V, Sreedhar Naik K. Determinants of total ischemic time in primary percutaneous coronary interventions: A prospective analysis. *Indian Heart J* 2018; **70**(Suppl 3): S275-S279.
- [17] Chandrasekhar J, Marley P, Allada C, McGill D, O'Connor S, Rahman M, et al. Symptom-to-balloon time is a strong predictor of adverse events following primary percutaneous coronary intervention: Results from the Australian Capital Territory PCI Registry. *Heart Lung Circ* 2017; **26**(1): 41-48.

Publisher's note

The Publisher of the *Journal* remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.