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Predictors of pre-hospital delay in seeking treatment among Jordanian patients with ST elevation myocardial infarction during COVID 19 pandemic

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***Abstract*---**Pre-hospital delay lead to delay in receiving appropriate and timely reperfusion therapy among patients with STEMI, which increases morbidity and mortality rate. The current study aimed to explore predictors of pre-hospital delay time among Jordanian patients with STEMI during COVID 19 Pandemic. A descriptive cross-sectional design was used on a convenience sample of 163 patients diagnosed with STEMI. Multiple linear regression was used to explore the predictors of pre-hospital delay time. The mean pre-hospital delay time was 2.7 hours (SD = 1.9). Only 3% of patients attended the hospitals within the first hour of the onset of symptom, and 38% of patients used civil defense ambulance services to present to hospitals. Having a family history of cardiac disease and being medically insured were associated with lower pre-hospital delay time. Jordanian patients with STEMI have a lower delay time when compared with other countries during COVID 19 pandemic. Many demographic and clinical factors were found to cause pre-hospital delay, and efforts should be made to raise patients' awareness regarding the consequences of longer pre_hospital delay time.

***Keywords*---**COVID-19 pandemic, pre-hospital delay, STEMI.

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Introduction

Jordan, as all countries worldwide were affected by the pandemic, governmental orders such as self-quarantine and social distance were imposed to limit the transmission of the COVID-19 virus. Patients with myocardial infarction fear contracting COVID-19 patients, which led to delayed hospital presentations and added significant morbidity and mortality (Aldujeli et al., 2020). ST-segment elevation myocardial infarction (STEMI) is a disease of high mortality that results from sudden occlusion of one or more coronary arteries and requires rapid and timely reperfusion therapy (James et al., 2018). Zhang et al. (2019) reported that achieving rapid and timely restoration of coronary blood flow in patients with AMI is essential to improve prognosis and reduce morbidity and mortality. Therefore, healthcare providers were highly concerned with screening patients for suspected COVID-19 infection, which may delay receiving appropriate and timely reperfusion therapy among patients with STEMI (Hayajneh, Rababa, & Al-Rawashdeh, 2020). However, the delay may be in the decision to seek medical care and arrive at the hospital, which is known as a pre-hospital delay.

Pre-hospital delay is the time between the onset of STEMI symptoms and arriving at the hospital (Nilsson, Mooe, Söderström, & Samuelsson, 2016). The pre-hospital delay has two components; the patient delay, defined as the time when the patient decides to seek medical help, and transportation delay is defined as the time to reach a healthcare facility (Beig et al., 2017). Mhalu et al. (2019) reported that more than 60% of delay time is related to a delay in the patient's decision to seek medical help. In the pre-COVID-19 era, the pre-hospital delay time was 2.5 hours among patients from 14 countries (Goldberg et al., 2009), and 3.8 hours reported by (Kragholm et al., 2017). In the COVID-19 pandemic, few studies had addressed pre-hospital delay among patients with STEMI, and the pre-hospital delay time was longer than the pre-COVID-19 era. Tam et al. (2020) reported that the mean pre_hospital delay was 5.3 hours during COVID 19 outbreak in China, while (Aldujeli et al., 2020) reported more than 10 hours pre_hospital delay time in Lithuania. In a study conducted in Jordan during the country lockdown, among older adults with ACS, the pre_hospital delay was 3.36 days (Hayajneh et al., 2020).

Many factors associated with pre-hospital delay include insufficient symptoms awareness, older age, female gender, inadequate insurance coverage, and long transportation pathways (Murugiah, Nuti, & Krumholz, 2014). Socio-demographic factors such as older age are recognized as predictors of prolonged delay in seeking treatment for AMI symptoms (Darawad, Alfasfos, Saleh, Saleh, & Hamdan-Mansour, 2016) and female gender (Ghaffari, Pourafkari, Tajlil, Bahmani-Oskoui, & Nader, 2017). Patients may also experience a typical symptom that occurs over an extended time, regarding transportation delay (Goldberg, Kramer, Yarzebski, Lessard, & Gore (2008) stated that most patients with signs and symptoms of AMI use alternative means of transportation to the hospital do not call for an ambulance. In addition, Jäger et al. (2017) reported that patients transported by ambulance were aging, primarily female, had multiple comorbidities, and were more likely to develop serious complications. This study aims to answer the following questions:

- What is the mean pre-hospital delay time among Jordanian patients with STEMI during COVID 19 Pandemic?
- Is there a difference in pre-hospital delay time among Jordanian patients with STEMI during COVID 19 Pandemic based on demographic and clinical characteristics?
- What predictors of pre-hospital delay time among Jordanian patients with STEMI during the COVID 19 Pandemic?

Methodology

Design

A descriptive cross-sectional design was used.

Setting

The study was conducted in Amman city, the largest region containing about 60 % of hospitals from all health care sectors. (Governmental, educational, and private). The hospitals will be eligible for the current study of coronary care units (CCU) and cardiac catheterization units. One educational hospital and only one public hospital were founded to have CCU, and cardiac catheterization unit was chosen. Two hospitals were chosen randomly from the eligible private hospitals. Patients with STEMI were recruited after 6 to 24 hours of reperfusion therapy when they were in stable condition in CCU.

After reviewing the admission process for patients with STEMI in the recruited hospitals, patients who were diagnosed with STEMI were stabilized and initially treated in Emergency Departments (ER), the cardiac catheterization team called, and the patient was transferred to ICU until the cardiac catheterization team arrives. During COVID 19 Pandemic, a rapid PCR test for COVID 19 must be done in ER before transferring the patient to ICU or cardiac catheterization. If the test is negative, cardiac catheterization protocol continues. If the test is positive, the patient is transferred to a hospital that admits COVID 19.

Sampling

The target population included all Jordanian patients diagnosed with STEMI, whereas the accessible population included Jordanian patients diagnosed with STEMI in the eligible hospitals in Amman city. The non-probability convenience sampling technique was used to recruit patients from CCUs who met the eligibility criteria, including (a) having a confirmed medical diagnosis of STEMI and (c) ability to comprehend the Arabic language. Whereas patients with NSTEMI and who have neurological deficits were excluded. One hundred sixty-three patients have met the inclusion criteria.

Instrument

The questionnaire package of this study consists of two parts. The first part contains the demographic (age, gender, marital status, and educational level) and clinical data (medical history, insurance, ACS diagnosis, type of hospital, and the delay times). The second part was the Myocardial Infarction Symptoms Survey (MISS), which consisted of two instruments; Myocardial Infarction Symptom Profile (MISP) and Modified Response to Symptoms Questionnaire (m-RSQ). The MISP mainly focus on the actual symptoms that the patient experienced prior to and during AMI, sequence of events from the onset of symptoms to EMS arrival, contextual data such as place and time of symptoms, and the actions taken to mitigate AMI symptoms or contact a health care providers (Zerwic, Ryan, DeVon, & Drell, 2003). The MISP obtained data about the cardiac events, including location and quality of pain and discomfort, related symptoms, onset, duration, and relief of symptoms. Each domain gives a detailed list of typical and atypical AMI symptoms and other items used to rule out a cardiac diagnosis. The questions were yes or no and open-ended, such as the onset of the AMI symptoms. Content validity was supported by four experts in the field of cardiology.

The modified response to symptoms questionnaire was developed by (Dracup & Moser, 1997). The modified response to symptoms questionnaire (m-RSQ) consisted of 18 items illustrating patient delay and factors. Seven domains were covered: (1) the context in which the AMI symptoms first appeared, (2) the antecedents of symptom onset, (3) behavioral responses to the symptoms, (4) affective and emotional response to the symptoms, (5) cognitive responses to the symptoms, (6) the response of others to patient symptoms and (7) cognitive, emotional, and social factors. The m-RSQ consisted of multiple-choice questions and a five-point Likert scale to measure participants' responses to the AMI symptoms. Individual items are used as subunits of analysis, and m-RSQ does not yield a total score. The psychometric properties of this questionnaire were assessed by Cronbach's alpha 0.82, which means strong internal consistency reliability (McKee et al., 2013). The Arabic version of the modified response to symptoms questionnaire will be used that was translated and used among Jordanian patients with ACS (Eshah, 2014). Furthermore, the internal consistency reliability of the Arabic version of the modified response to symptoms questionnaire was ensured by Cronbach's alpha $\alpha = 0.78$ (Eshah, 2014).

Ethical considerations

The ethical approval was obtained from the Institutional Review Board (IRB) committee at the school of nursing at the University of Jordan, and each participating hospital before data collection began. Eligible patients who showed interest in participating in the study were invited to be involved in the study and sign the consent form containing the study aims, procedure, benefits, and risks. Further, the participants were informed that participation in the study was voluntary. There are no risks from participating in the study and no direct benefits from the study except helping in improving the care and prognosis of AMI patients. Privacy and confidentiality were ensured in all phases of the study. The received information was used only for research purposes, and the primary investigator was the only one who had access to the patient information. The questionnaires were coded without mentioning the patient's identity. The completing questionnaires were kept in a closed cupboard at the researcher's office.

Data collection procedure

All patients who met the inclusion criteria were included in the study. Demographic, clinical, and socioeconomic data (age, gender, chronic diseases, family income, etc.) were collected by direct question to the participants and review of medical records. Then the participants were asked about the time of symptoms initiated and until presented to the emergency room. The delay time interval was extracted from the documented time on the admission form, and if the time is not available, the patient will be asked to report the time. Pre-hospital delay is defined as (the time between the onset of ACS symptoms and the time of reaching the emergency department). Data collection was conducted between January and April 2020.

Data analysis

Data were analyzed using the statistical package for social sciences (SPSS version-23). The data was scanned for the missing and outliers, and the total missing data did not exceed 5% and was replaced with the variable mean. Further, the variables were tested for parametric assumption, and the total scores for delay time were computed. To answer the first research question, descriptive statistics (means and standard deviations) were used. The second question was answered using an independent sample t-test and a one-way analysis of variance (ANOVA) test to detect differences in delay time based on categorical variables. Finally, a multiple linear regression test was used to identify predictors of delay time (third question).

Results

Participants' age ranged from 25 to 85 years (M = 55.3, SD = 11.7), and they were predominantly males (76.7%, n = 125), married (84.7%, n = 130), about half of them educated at university level (48.7%, n = 79), more than half unemployed (52.1%, n = 85), with mean income 189.0 ±166.2 JOD, insured (54%, n = 88), and from private sector (49.1%, n = 80). Regarding their medical history (36.8%, n=56) have hypertension and (44.2%, n=72) have diabetic mellitus and (39.9%, n = 65) of the participants have family history of cardiac diseases. The mean pre-hospital delay time was 2.7 hours (*SD* = 1.9, median = 2.5). Only 5 (3.1%) patients attended the hospitals within the first hour of the symptom onset, whereas 68 (41.7%) between 2 to 3 hours after chest pain onset. We noted that only (62, 38%) patients used civil defense ambulance services to present to hospitals, while more than half of the patients (93, 57.1%) were transported to the hospitals by private cars.

Examining differences in pre_hospital delay time based on patient demographics and clinical variables. The result shows no significant differences between males and females. Whereas insured, unmarried, high school educated, and a family history of cardiac diseases have a shorter pre_hospital delay time (Table 1). Multiple linear regression was used to answer the third research question about identifying the predictors of pre_hospital delay time. All continuous and dichotomous categorical variables that show correlation with pre_hospital delay time were entered in analysis see (Table 2). The results revealed that two predictors (Have a family history of cardiac disease and medical insurance) explained about 60% of the variance in pre_hospital delay time among patients with STEMI ($R2= 0.59$, $F (9,153)= 9.089$, $p= 0.001$). Medical insurance showed a stronger predictor than having a family history of cardiac disease (Table 3).

Discussion

The current study aimed to identify pre_hospital delay time in seeking care among Jordanian patients with STEMI during COVID 19 pandemic. The mean pre_hospital delay time was 2.7 hours, which was typical of 2.7 hours reported by (Goldberg et al., 2009) among patients from 14 countries, and 3.8 hours reported by (Kragholm et al., 2017) that conducted in the pre-COVID 19 pandemic era. However, during COVID 19 pandemic, the reported pre_hospital delay time was longer than the current study. Tam et al. (2020) reported that the mean pre_hospital delay was 5.3 hours during COVID 19 outbreak in China, while (Aldujeli et al., 2020) reported more than 10 hours pre_hospital delay time in Lithuania. In a study conducted in Jordan during the country lockdown, among older adults with ACS, the pre_hospital delay was 3.36 days (Hayajneh et al., 2020). When comparing pre_hospital delay time among Jordanian patients with STEMI with other countries during COVID 19 pandemic, we can say that Jordanian patients with STEMI have lower pre_hospital delay time when compared with other countries. This lower delay time will increase the rate of timely reperfusion success.

The current study found that only 3% of patients attended the hospitals within the first hour of symptom onset. This result was congruent to some extent with (Darawad et al., 2016), who found that none of the patients with ACS arrived within the first hour from the onset of symptoms. These findings increase the need for intervention to republic awareness regarding immediate response and seeking medical care if STEMI symptoms are experienced. On the other hand, the results show that only 38% of patients used civil defense ambulance service to present This result was congruent with (Mesas et al., 2018), who reported that EMS services were used in 24% of patients with AMI. In contrast (Goldberg et al., 2008) reported that 70% of patient with AMI was transported to the hospital by ambulance. Moreover, during the COVID 19 pandemic in Jordan (Hayajneh et al., 2020) reported that patients with ACS who had used public transportation arrived at the hospitals earlier than those who had used an ambulance.

Examining differences in pre_hospital delay time during COVID 19 based on patients' demographical and clinical variables revealed a shorter delay among patients insured, unmarried, high school educated, and who have a family history of cardiac diseases. The same result was reported by (Darawad et al., 2016) among the Jordanian population, except for employment status and male gender, indicating a persistent need to target patients with STEMI and increase their awareness about timely seeking care. Lack of insurance was a significant variable correlated with pre_hospital delay time in many studies (Darawad et al., 2016; Eshah, 2014; Peng et al., 2014) because patients were unable to pay medical expenses, which leads to use available home medication and may deny symptoms. There was no significant difference in pre_hospital delay time related to gender; this result was congruent with (Hayajneh et al., 2020) while not consistent with other studies (Darawad et al., 2016; Eshah, 2014; Peng et al., 2014). This could be attributed to the fear that COVID 19 disease was equal in both males and females, and the previous studies sample was ACS in general, not specific to STEMI.

Regarding predictors of pre_hospital delay time, only two predictors (Have a family history of cardiac disease and medical insurance) significantly predicted pre_hospital delay time. These factors may logically predict the delay time, while previous studies have other variables that predict pre_hospital delay time. However, holistic educational programs that consider all patients' demographical and clinical variables and are targeted to raise public awareness can benefit to reduce pre_hospital delay time among patients with STEMI.

Conclusion

In conclusion, this study found that Jordanian patients with STEMI have a lower delay time when compared with other countries during the COVID 19 pandemic; this increases the percentage of patients that benefit from reperfusion therapy and decreases long-term cardiac output complications. Many demographic and clinical factors resulted in this delay, and efforts should be made to raise patients' awareness regarding the consequences of longer pre_hospital delay time. Balance must be made between hospital strategies to decrease the spread of COVID 19 and the goals of achieving timely reperfusion therapy.

Conflict of interest

There is no potential conflict of interest to declare

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Table 1
Comparison of study variables based on demographics (n = 163).
Demographical characteristics of the sample (n=163)

Characteristics	N (%)	M (SD)delay time
Gender		
Male	125	2.70(0.9)
Female	38	2.49(1.0)
Marital status		
Married	138	2.72(1.0)
Un-married	25	2.30(0.6)*
Insurance		
Insured	88	2.91(0.7)**
Uninsured	75	3.91(1.0)
Family history of cardiac diseases		
Yes	65	2.38(0.7)**
No	98	3.86(1.0)
Employment status		
Emploement	52	2.81(0.9)
Unemploee	111	2.58(1.0)
Education		
Elementary	33	2.44(0.8)
High school	51	2.94(1.0)8
University	79	2.55(1.0)

Type of health care sector		
Public	41	2.90(0.9)
Private	80	2.60(1.1)
Educational	42	2.50(0.8)*

* Significant at $P < 0.05$, **Significant at $P < 0.01$.

Table 2
Correlation between demographical and clinical variables with delay time

	r	Correlation with the pre-hospital delay time
Family cardiac disease	.264	0.001**
Medical insurance	.514	0.001**
Marital status	-.083	0.290
Chronic disease	-0.034	.663
Education level	0.012	.877
Sectors	-.142	.070
Income	.191	.014 *
Employment status	-.165	.035 *
Gender	-.102	.197
Residence	0.036	.649
Age	.116	0.140

* Significant at $P < 0.05$, **Significant at $P < 0.01$.

Table 3
Linear regression analysis predictors of pre-hospital delay time

Variables	B	Beta	t	p
Have family history of cardiac disease	17.365	.140	2.028	.044 *
Married participants	-15.034	-.089	-1.287	.200
Governmental Sectors	-16.338	-.117	-1.712	.089
Employed participants	-7.528	-.058	-.610	.543
Male gender	-6.569	-.046	-.675	.501
High Income	.045	.123	1.334	.184
Age	.559	.108	1.396	.165
Have chronic diseases	-.698	-.009	-.122	.903
Have medical insurance	55.370	.454	6.606	.000 **

Note: R^2= 0.59, F (9,153)= 9.089, p= 0.001, ** P< 0.01, * < 0.05