

Original Research Article

Pre-hospital care in stable patients with acute coronary syndrome: Factors and predictors of pre-hospital delays in a tertiary public health institute

Mandreker U. Bahall*, George Legall

School of Medicine, University of the West Indies, St Augustine campus, Trinidad and Tobago

Received: 18 August 2017

Revised: 04 November 2017

Accepted: 06 November 2017

*Correspondence:

Dr. Mandreker U. Bahall,

E-mail: vmandrakes@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Incidences of pre-hospital delays (PHDs) remain high and affect the outcomes in acute coronary syndrome (ACS) patients. This study explored the factors associated with, and the predictors of PHD in ACS patients.

Methods: Data were collected through interviews and the examination of the hospital records of 299 ACS patients admitted to a hospital between 1 December 2014 and 28 February 2015.

Results: The patients were primarily female, and their mean age was 60.9 ± 12.09 years. The mean PHD was 7.5 ± 6.6 hours; this comprised mean delay from symptoms onset to departure, mean travel time from departure time to intermediate care facility, mean length of stay at intermediate care facility, and mean travel time from an intermediate care facility to hospital. The factors associated with delays were ignoring of symptoms (38.8%), indecisiveness and reluctance to seek treatment (16.7%), self-medication (35.5%), being unconvinced that the symptoms were serious (61.2%), and waiting for a worsening of pain (29.1%). The predictors of PHDs were 'marital status', 'fear of having a heart attack', 'believing that the symptoms were self-limiting', and 'seeking intermediate care'. The predictors of hospital delays were 'AM or PM occurrence of symptom', 'shortness of breath', 'having hypertension', and 'previous ischaemic heart disease'.

Conclusions: Patient delays were high in the case of ACS, but utilization of an intermediate healthcare facility more than doubled the PHD. About two-thirds of the patients had a PHD that exceeded 2 hours.

Keywords: Pre-hospital delay, Patient delay, At-hospital delay, Psychological factors, Healthcare, Acute coronary syndrome

INTRODUCTION

Coronary artery disease commonly presents as acute coronary syndrome (ACS). About 35-50% of acute myocardial infarction (AMI)-related deaths occur before arrival at a hospital.¹ This trend persists despite evidence that effective pre-hospital care leads to decreased disease complications, improved survival and quality of life.² The outcomes of those who survive depend on timely and appropriate continued care in the emergency department,

as well as during the in-patient and post-discharge periods (Table 1).

Pre-hospital care is defined as the preventive and therapeutic measures rendered to patients with suspected or proven AMI during the interval between the onset of symptoms and arrival at a hospital that is equipped to provide definitive medical care.³ In order to improve outcomes and decrease pre-hospital mortality, healthcare authorities have invested in educating the public, and

providing mobile coronary care units, ambulances, and emergency department chest pain units.³ This facilitates early calls for help, timely transport, immediate emergency triage, prompt electrocardiogram acquisition, chest pain evaluation, and emergency treatment. In

Trinidad and Tobago, there is a lack of available data for the substantiation of anecdotal claims about pre-hospital care problems and PHDs. The aim of this study was to determine PHD times, reasons for PHDs, and the factors and predictors of PHDs.

Table 1: Pre-hospital action strategy.

Patient presentation	Action taken	Guideline target times	Time indicators
Symptom recognition	GTN×2	Immediate	Recognition time
Symptom persistence (more than 5 minutes).	Call ambulance	Call time within 5 minutes of onset of initial symptoms	Decision time Patient delay time*
Transfer to nearest cardiac facility	In-transit care. Oxygen/ECG/thrombolysis if necessary	Transfer time within 30 minutes	Transfer time**
Triage in the A & E	Assessment by triage officer	Immediate triage on arrival in A & E (within 5 mins of arrival)	Hospital delay time Triage time

Total pre-hospital delay time=Patient delay time*+Transfer time**

GTN=Glyceryl trinitrate; A&E=Accident and Emergency department; ECG=Electrocardiogram.

METHODS

A cross-sectional study was conducted among stable patients with ACS admitted to the medical wards of San Fernando General Hospital, one of the three main public hospitals in Trinidad and Tobago. The study was conducted between 1 December 2014 and 28 February 2015. Patients clinically diagnosed with ACS were identified using hospital admission records. Patient inclusion criteria were: adults over the age of 18 years, who were not sedated, who had no communication problem, who were not confused (i.e. no cognitive problems), who were able to remember events of their admission, and who were able to endure a 15-minute face-to-face interview. The exclusion criteria included patients who were re-assessed as having non-cardiac chest pain such as gastro-oesophageal reflux disease, chest wall pain, pneumonia, or other diseases that may also present with chest pain, and patients who experienced recall problems, as determined by a research assistant.

A sample size of 322 was determined as required for the estimation, with a margin of error of 5%.⁴ The questionnaire, used for data collection, comprised socio-demographic variables (age, sex, ethnicity, marital status, occupation, and highest level of education), clinical presentation variables (symptom at onset, whether the patient was alone at the symptom onset, suddenness and severity of pain [rated on a scale of 0 to 10; 0- no pain, 10- pain of the highest severity], medical history of ischaemic heart disease) and situational variables (place, date and time of symptom onset, time of departure to seek medical help, mode of transport, and whether the patient was taken to an intermediate healthcare institution before reaching the hospital [with corresponding arrival and departure times]). Symptoms of interest included

typical chest pain, sweating, shortness of breath, vomiting, dizziness, and atypical chest pain.

After a pilot study of 20 patients was conducted by medical students, the questionnaire was revised. Questionnaires completed during the pilot study were not accepted in the final study due to inadequate data. Face-to-face interviews were conducted with stable patients between the second and fourth days, after admission. Information was obtained using a combination of structured interviews and patients' notes. Clarification on the patients' clinical presentation and management were obtained from the doctors responsible for the patients.

Data were entered into a secured computer database, using IBM SPSS Statistics 21 software (IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.), and researchers and assistants were given access. The analysis was conducted using descriptive (frequency tables) and inferential (hypothesis testing via ANOVA and Chi-square analysis) statistical methods and testing at the 5% level of significance. A logarithmic (to base 10) transformation was applied to both travel and waiting times to satisfy the data normality condition necessary for using ANOVA to compare means.

Definitions of the studied factors

Patient delay was defined as the time (in minutes) between the symptom onset and departure to obtain medical care. Total PHD was the time interval (in minutes) from the symptom onset to arrival at an appropriate hospital. Hospital delay was the time (in minutes) between arrival at a hospital and the start of treatment by an emergency physician. In this study, a PHD of over 2 hours was considered to be a risk factor for unfavourable patient outcomes.⁵ Similarly, a hospital

delay of over 5 minutes was considered unfavourable (Table 1).⁶

RESULTS

Demographic, clinical, and situational factors

Of the 326 enrolled patients, 10 patients declined participation, 7 could not be interviewed due to medical constraints, 9 were not available due to clinical engagements, and 1 patient aborted the interview before a useful amount of data was collected. Thus, by the end of the data collection, a total of 299 patients (92.9% of the required sample size) successfully participated in the study.

Table 2: Frequency distribution of selected demographic variables.

Variable	N	%
Sex		
Male	141	47.2
Female	158	52.8
Ethnicity		
Afro-Trinbagonian	55	18.4
Indo-Trinbagonian	230	76.9
Mixed	14	4.7
Marital status		
Single	80	26.8
Married/living-as-married	170	56.9
Divorced	11	3.7
Widowed	38	12.7
Highest level of education		
Less than primary school	19	6.4
Primary school	199	66.6
Secondary school	68	22.7
Tertiary	10	3.3
No response	3	1.0
Occupation		
Blue-collar	100	33.4
Unemployed	88	29.4
Retirees	103	34.4
Other	5	2.6
No response	1	1.0

Of the 299 participants, 52.8% were female (n=158), 76.9% were Indo-Trinbagonians (n=230), and 18.4% were Afro-Trinbagonians (n=55). Further, 56.9% of the patients were married/living-as-married (n=170); 66.6% were primary school-educated (n=199), 33.4% were blue-collar workers (n=100) and 34.4% were retirees (n=103) (Table 2). The patients' mean age was 60.9±12.09 (range 23-62) years (Table 3).

Furthermore, using the t-test, the equality of mean ages showed that there were no statistically significant differences between the mean ages of the male and female patients (p=0.87) or among the 3 ethnic groups

(Indo-Trinbagonians, Afro-Trinbagonians, and mixed) (p=0.28).

Table 3: Selected summary statistics.

Variable	N	Mean age	SD
Gender			
Male	141	61.0	11.92
Female	158	60.8	12.28
Ethnicity			
Afro-Trinbagonian	55	60.6	15.31
Indo-Trinbagonian	230	61.3	11.28
Mixed	14	56.0	10.35
Overall	299	60.9	12.09

SD = Standard deviation

Of the study population, 74.6% of the patients presented with hypertension, 58.5% with diabetes mellitus, 35.8% with hypercholesterolemia, 1.7% with a previous coronary artery bypass graft, and 1% with a previous percutaneous transluminal coronary angioplasty/stent. Current smokers accounted for 12.0% and ex-smokers 23.7% of the population. Even though 15.7% of the patients reported 'other' when queried about risk factors, none of them specified the identity of the factor(s) (Figure 1). Furthermore, 3.3% of the patients did not present any of the risk factors listed in the questionnaire, 15.7% had only 1 of them, and 1.3% had 6. The most common risk factor among patients with a single risk factor was hypertension (n=17; 36.2%).

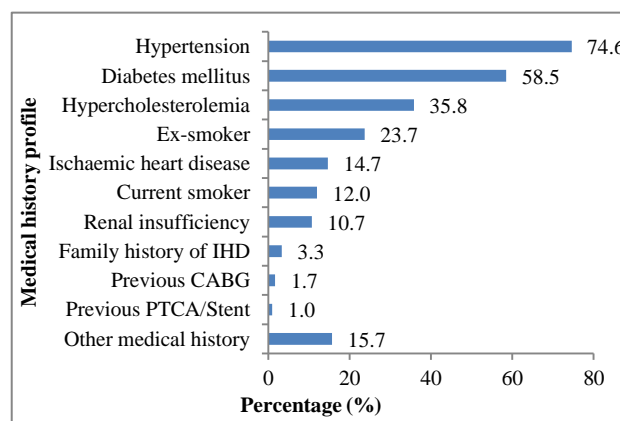


Figure 1: Medical history profile of the study participants.

IHD, ischaemic heart disease; CABG, coronary artery bypass grafting; PTCA, percutaneous transluminal coronary angioplasty.

The 5 most prevalent symptoms were classic chest pains (n=254; 84.9%), dizziness (n=189; 63.2%), shortness of breath (n=183; 61.2%), sweating (n=179; 59.9%), and nausea (n=123; 41.1%) (Table 4).

The majority of patients (n=143; 47.8%) began experiencing symptoms between midnight and noon; 23.1% (n=69) experienced symptom(s) between noon and

6 pm; and for the remaining patients (n=87; 29.1%) the period of occurrence was between 6 pm and midnight. The number of presenting symptoms ranged from 1 (n=24; 8.0%) to 8 (n=6; 2.0%); the mean was 4 (SD: 1.67) and the median number of symptoms was also 4. The onset of classic chest pains was described as gradual (n=74; 29.1%), sudden (n=174; 70.9%), intermittent (n=101; 29.8%), or continuous (n=153; 60.2%), while the intensity was described as mild (n=21; 8.3%), moderate (n=80; 31.5%), or severe (n=151; 59.4%).

Table 4: Symptoms experienced by the patients.

Symptom	N	%
Chest pains	254	84.9
Sweating	179	59.9
Blackout	30	10.0
Atypical chest pain	71	23.7
Dizziness	189	63.2
Nausea	123	41.1
Palpitations	96	32.1
Near-fainting	56	18.7
Shortness of breath	183	61.2
Other	10	3.3

Furthermore, 88.3% (n=264) of the participants experienced the first sign of the onset of symptom(s) while at home, 7.0% (n=21) at work, 3.3% (n=10) at other unspecified locations, and 1.3% (n=4) did not state the location. Of the patients who experienced their symptom first at home, 38 (14.4%) of the 264 patients were alone at the time, 85.2% of the patients were with a spouse or at least 1 other family member, and 0.4% were with a friend.

Patients were transported to a local health centre (n=131; 43.8%), or to a general practitioner (n=12; 4.0%) for intermediate care, or directly to the hospital (n=154; 51.5%). Health centres and general practitioners' offices were regarded as intermediate healthcare facilities, as all the patients were eventually taken to the hospital. The modes of transportation were as follows: private vehicles (n=163; 54.5%), emergency medical services (EMS; n=114, 38.1%), public transportation (n=20; 6.7%), or by foot (n=2; 1.7%). Of the patients, 10.4% reported having to wait long for transportation, and only 3.7% had some form of difficulty in obtaining transportation.

Initial reactions/reasons for patient delay

On experiencing chest pain, patients' initial reactions varied: ignoring symptoms (n=116, 38.8%), indecisiveness and reluctance to seek treatment (n=50, 16.7%), not believing that they were having a heart attack (n=25; 21.6%), not being convinced that their symptoms were serious (n=71; 61.2%), or choosing to wish or pray for the pain to disappear (n=38; 32.8%) (Table 5). Further, 4 patients regarded their situation as a cause of embarrassment, 5 had to leave other chores undone (e.g. caring for relatives), 6 lived in rural locations, and only 5 were concerned about the cost of medical care.

Table 5: Measures taken, and reasons for indecisiveness and reluctance to seek medical care.

Reason	N	%
Ignoring symptoms	116	38.8
Not believing they were having a heart attack	25	21.6
Not convinced that the symptoms were serious	71	61.2
Wishing or praying for symptoms to disappear	38	32.5
Indecisiveness and reluctance to seek treatment	50	16.7
Did not want to bother anyone	25	8.4
Consulted a friend or family member	83	27.8
Waited until symptom became unbearable	87	29.1
Did not know what to do	54	18.1
Used alternative medicines such as herbs	9	3.0
Used conventional medicines such as analgesic, gas tablets, or antacids	28	9.4
Chewed/took aspirin or used GTN sublingually	106	35.5
Failed to recognize a heart attack	13	4.3
Fearful of having a heart attack	33	11.0
Believed the symptom was self-limiting, would not return, and the problem had been resolved	22	7.4

GTN = Glyceryl trinitrate.

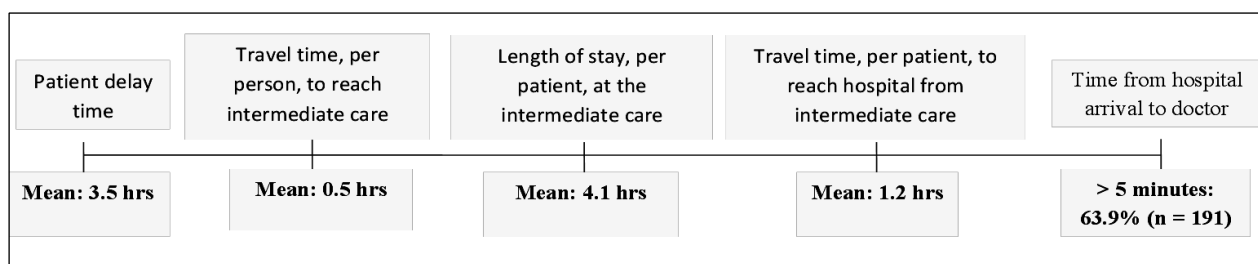


Figure 2: Timeline from symptom onset to treatment.

Pre-hospital delay

The mean PHD was 7.5 hours, range (0.13, 36.5) hours; comprising patient delay or mean delay from time of onset to seeking care of 3.5 hours, range (0.08, 28.0) hours, mean travel time from the place of onset to an intermediate care facility of 0.5 hours, range (0.08, 6.3), mean length of stay at an intermediate care facility of 4.1 hours range (4.0, 20.5) hours, and mean travel time from an intermediate care facility to a hospital of 1.2 hours, range (1.01, 2.1) hours. Overall, the majority of patients (n=288; 96.3%) reported more than a 5-minute delay between the onset of chest pain and departure to the

hospital, 69.2% (n=207) patients had a PHD of more than 2 hours, and only 36.1% (n=108) had a hospital waiting time, from arrival to treatment, of no more than 5 minutes (Figure 2).

Predictors of pre-hospital delay

The factors and useful predictors associated with PHDs were: ignoring the symptoms ($p \leq 0.001$), fear of getting a heart attack ($p = 0.001$), and whether treatment was sought at an intermediate care facility ($p \leq 0.001$) (Table 6). A factor that was associated with delay ($p = 0.001$) but was not a useful predictor was patients' fear of embarrassment.

Table 6: Regression coefficients with corresponding p-values.

Variable	Regression coefficients (p-value)		
	Patient delay	Hospital delay	Total (pre-hospital) delay
Ethnicity	0.14 (0.243)	-0.031 (0.642)	0.105 (0.359)
Pain severity	0.005 (0.945)	0.030 (0.432)	0.016 (0.805)
Number of non-chest pain symptoms	0.001 (0.972)	-0.001 (0.972)	0.001 (0.989)
Being at home	0.243 (0.157)	-0.134 (0.164)	0.128 (0.432)
Being alone	0.036 (0.813)	0.025 (0.766)	0.045 (0.755)
Previous IHD	-0.258 (0.170)	0.003 (0.976)	-0.296 (0.098)
Transported by ambulance	-0.009 (0.936)	-0.266 (≤ 0.001)	-0.131 (0.236)
More than three risk factors	0.121 (0.478)	0.048 (0.619)	0.133 (0.415)
Knowledge of heart attack	-0.144 (0.333)	-0.129 (0.121)	-0.208 (0.142)
Knows someone with heart attack	0.057 (0.660)	0.004 (0.953)	0.081 (0.512)
Ignored symptoms	0.460 (≤ 0.001)	-0.090 (0.154)	0.382 (≤ 0.001)
Fear of heart attack	-0.583 (0.001)	0.061 (0.542)	-0.407 (0.018)
Fear of embarrassment	0.476 (0.313)	0.870 (0.001)	0.799 (0.076)
Seeking intermediate treatment	1.075 (≤ 0.001)	-0.026 (0.681)	0.892 (≤ 0.001)

The useful predictors of at-hospital delays were (1) whether patients were transported to the hospital in an ambulance ($p \leq 0.001$), and (2) patients' fear of embarrassment ($p = 0.001$). The coefficients for 'ignoring the symptom', 'fear of heart attack' and 'seeking an intermediate healthcare provider' were positive, negative, and positive, respectively. The coefficients for 'transported in an ambulance' and 'fear of embarrassment' were negative.

Table 7: Significant factors associated with pre-hospital delay exceeding two hours.

Predictors	P value
Marital status	0.010
Whether the patient suffered a blackout	0.014
Experienced palpitations	0.027
Experienced shortness of breath	0.047
Waited until the symptom became unbearable	0.019
Sought intermediate treatment	≤ 0.001
Place where medical attention was sought	≤ 0.001

In the interest of keeping the regression analysis simple a subset of variables that would have been ordinarily used as predictors was omitted and used instead to test for the association with whether the PHDs exceeded 2 hours. Significant associations were observed between PHDs exceeding 2 hours and the following factors: marital status ($p = 0.010$), whether the patient suffered a blackout ($p = 0.014$), if palpitations were experienced ($p = 0.027$), if shortness of breath was experienced ($p = 0.047$), if the patient waited until the symptoms became unbearable ($p = 0.019$), if the patient sought intermediate treatment ($p \leq 0.001$), and the place where medical help was sought ($p \leq 0.001$) (Table 7).

Useful predictors of pre-hospital delays greater than 2 hours and hospital delays greater than 5 minutes

Using binary logistic regression techniques, we found that, of all the independent variables used in the model, 'marital status: $p = 0.034$, odds ratio (OR)=1.547 (95% confidence interval (CI)=1.034-2.314), 'fear of having a heart attack': $p = 0.024$, OR=0.185 (95% CI=0.043-0.800), 'believing that the symptoms were self-limiting': $p = 0.048$, OR=6.977 (95% CI=1.020-47.733), and

‘seeking intermediate care’: $p \leq 0.001$, OR=15.261 (95% CI=4.190-55.588) were the only useful predictors of PHDs of over 2 hours (Table 8).

Similarly, ‘AM or PM occurrence of symptoms: $p=0.044$, OR=0.686 (95% CI=0.476-0.991), ‘shortness of breath’:

$p=0.008$, OR=2.473 (95% CI=1.266-4.829), ‘having hypertension’: $p=0.030$, OR=2.450 (95% CI=1.091-5.503), and ‘previous ischaemic heart disease’: $p=0.022$, OR=4.566 (95% CI=1.239-16.819) were found to be useful predictors of hospital delays of over 5 minutes (Table 8).

Table 8: Useful predictors of pre-hospital delays greater than 2 hours and hospital delays greater than 5 minutes.

Useful predictors	P value	OR	95% CI
Pre-hospital delay >2 hrs			
Marital status	0.034	1.547	1.034-2.314
Fear of having a heart attack	0.024	0.185	0.043-0.800
Believing that the symptoms were self-limiting	0.048	6.977	1.020-47.733
Seeking intermediate care	≤ 0.001	15.261	4.190-55.588
Hospital delay >5 mins			
AM or PM occurrence of symptom	0.044	0.686	0.476-0.991
Shortness of breath	0.008	2.473	1.266-4.829
Hypertension	0.030	2.450	1.091-5.503
Previous IHD	0.022	4.566	1.239-16.819

OR = odds ratio; CI = confidence interval; 95% CI for OR is presented

DISCUSSION

This is the first study of its kind, in Trinidad, that analysed the pre-hospital care of stable patients with ACS at a tertiary healthcare institution. The tertiary healthcare institution provides tertiary and secondary care to nearly 600,000 people (about half of the population of Trinidad).⁷ Stable ACS, though not life-threatening, may potentially lead to severe consequences. PHDs, especially if compounded by a lack of appropriate treatment, are associated with an increased risk of in-hospital complications such as recurrent ischaemia, re-infarction, sustained ventricular tachycardia or fibrillation, and cardiac death.⁸ At the time of the initial presentation, however, these consequences are unknown to patients and healthcare providers. In this study, all the patients were treated for ACS, and the vast majority (over 90%) of them were discharged with a diagnosis of ACS/unstable angina, as defined by Kumar and Cannon.⁹

The participants were predominantly Indo-Trinidadians, with a mean age of 60.9 ± 12.09 (range 23-62) years. The risk factors of hypertension, diabetes mellitus, and hypercholesterolemia were common among them; this is in keeping with a coronary heart disease analysis conducted elsewhere.¹⁰ Patients commonly presented with classic chest pain, ($n=254$; 84.9%): sudden (174; 70.9%) or severe ($n=151$; 59.4%), with a mean severity (on a scale of 1 to 10) of 6.6 and a median of 7. A majority (47.8%) of the patients experienced symptoms between midnight and noon. This contrasts with the findings of Lewin et al, who stated that patients presented with symptoms from 8 to 10 am, and the symptoms peaked late in the evening, from 10 pm to midnight.¹¹ Another study reported that a majority of presentations were observed between 8 and 10 am.¹² A majority of the patients experienced the symptoms at home, in the

presence of a spouse or close relative. Patients may, therefore, benefit from proper support and emergency services, including, emergency automatic dialling for medical help

In our study, the mean patient delay was 3.5 hours i.e. about half the total PHD. Patient delays, although avoidable, far exceeded the 5-10 minutes recommended for departure to a hospital from the time of the onset of symptoms.¹ Patient delays were attributed mainly to psychological factors (ignoring symptoms, fearful of heart attack, praying for symptoms to disappear), personal reasons (waiting until pain becomes unbearable), and the lack of knowledge (not convinced that the symptoms were serious, did not know what to do). A few patients resorted to complementary and alternative medicine (3%) and some (9.4%) to non-ACS conventional medicine treatment. However, most of the patients simply took aspirin and glyceryl trinitrate, sublingually (35.5%). According to Zerwic, patients' delay in decision-making accounts for almost two-thirds of PHDs.⁵ Henriksson et al found that patients' disbelief and indecisiveness accounted for the highest PHDs.¹³ Some patients had problems interpreting the symptoms, reflecting their lack of knowledge. The mismatch between patients' interpretation of symptoms and the progression of disease has been reported to be as high as 58%.¹⁴ Further, in our study, only a small percentage of the patients had to complete their daily chores before seeking medical attention or were embarrassed to seek treatment. Social issues, therefore, did not contribute significantly to patients' indecisiveness and reluctance to seek treatment. Other studies reveal that patient delays were associated with sex (women had longer PHDs, as they took longer time to make decisions), ethnicity (an increased PHD, in the case of AMI, was found among the Asian and Latino populations in the USA),

indecisiveness, fear, atypical presentation, lack of information, misinterpretation, reluctance to call a physician, lack of encouragement, and having a medical history and depression.¹⁵⁻¹⁷

PHDs were further exacerbated when patients sought treatment at an intermediate care facility, which may not be equipped to deal with cardiac emergencies. The total mean travel times to arrive at, stay in an intermediate health institution, and subsequently arrive at the hospital were 0.5, 4.1, and 1.2 hours, respectively. Delayed transit times are a major concern since they can worsen prognoses.¹⁸ Travel time is determined largely by external factors such as the modes of transport and distance from the hospital. According to the Emergency Cardiovascular Care guidelines, travel-time delays result from inappropriate transport and traffic jams.¹ In this study, however, though travel time added to the delay, the biggest delay occurred at the intermediate healthcare facility itself followed by patients' delay in seeking treatment. Others have also noted that patients with ACS, who seek medical attention at an intermediate facility, may be misdiagnosed or have unnecessary delays.⁶ Therefore, to expedite treatment, it would be appropriate for intermediate healthcare providers to equip their facilities appropriately.¹⁹

In our study, at-hospital delays were another cause of concern. At our hospital, a majority of patients (63.9%, n=191) were treated after the recommended 5 minutes. Hospital delays are a function of the emergency care of the healthcare provider (such as access to the hospital, immediate emergency triage, quick ECG acquisition, and prompt evaluation/treatment by a doctor). Lambrew et al reported that this resulted from a lack of standard protocols, lack of an effective triaging system, staff problems, and inadequate resources.²⁰

The mean total PHD was 7.5 hours; over 69% of the participants arrived at the hospital for definite treatment only after 2 hours, and this is unacceptably long.^{21,22} Treatment response, as well as outcomes are undeniably a function of timely treatment, which is essential in preventing complications.²³ Half of the patients who die of AMI do so before reaching a hospital.¹ De Luca noted that every delay of 30 minutes was associated with a relative risk for 1-year mortality in AMI patients.²¹ In the USA, it was reported that the duration from the symptom onset to treatment was 180 minutes (twice the recommended standard) in 50% of the patients; fewer than 5% were treated within 90 minutes.²⁴ This has resulted in many healthcare authorities investing in mobile coronary units and ambulances for quicker response and to improve the rates of timely assessment and treatment such as thrombolysis, arrhythmias control and basic or advanced life support.

McKee et al showed that the main predictors of PHDs fall into 4 categories: socio-demographic factors; clinical factors; situational, appraisal, and behavioural factors;

and knowledge and beliefs.²⁵ In addition, it was also reported that a longer PHD was singularly and significantly associated with predictors such as taking medications, visiting family physicians, and symptoms that were intermittent in nature.²⁵ In our study, the useful predictors for total PHDs were the same as those for patient delays, i.e. whether patients ignored symptoms ($p \leq 0.001$), fear of getting a heart attack, and whether patients sought treatment at an intermediate care facility (Table 6). In the case of at-hospital delays, the useful predictors were whether patients were transported to the hospital in an ambulance ($p \leq 0.001$), and fear of embarrassment ($p = 0.001$). Similar predictors of hospital delays were reported by McKee et al.²⁵

Aggressive treatment in the first 2 hours, post symptom onset and preferably within the 'golden hour',²⁶ leads to a much lower mortality and reduced instances of disease complications. However, in our study, less than 30% of the patients were treated within 2 hours. Delayed treatment only worsens clinical outcomes. More than 50% of the patients delayed making a decision by 1 hour (mean 3.5 hours). Patients should seek medical help within 5 minutes in the absence of relief from chest pain, and arrive at an appropriate healthcare centre within 30 minutes, and the triage time at the emergency health facility should not exceed 5 minutes.¹ Early symptom-recognition, quick EMS calls and EMS response, speedy transportation from the location of the onset of symptoms to a hospital, timely triage and treatment are mandatory for the improvement of clinical outcomes.¹ As was also noted in our study, patient delays are a function of patients' psychological and personal factors.^{16,27} Social factors played no significant role in patient delays.

The study has a number of limitations. Firstly, it is a single-centre study, which reviewed relatively stable patients. Secondly, critically ill patients or those with significant myocardial damage, admitted to the cardiac ward, were excluded. Thirdly, the sample was non-randomised, and relatively small, and it was difficult to conduct subset analyses. Finally, recall bias was an issue since the study depended entirely on patients' ability to recall the estimated times of key events such as the onset of symptoms, time of departure from home, time of arrival at a healthcare facility, and time of start of treatment.

CONCLUSION

Patient delays account for significant delays in the pre-hospital care of patients with ACS, with more than 50% patients taking greater than 1 hour to depart to the hospital. Patient delays result mainly from ignoring symptoms, indecisiveness, reluctance to seek treatment, self-medication, waiting for a worsening of pain, seeking advice from non-medical professionals, using complementary and alternative medicine or just hoping for a resolution. Notably, patient delays more than doubled when patients accessed treatment at an

intermediate healthcare facility. Social and environmental issues, however, did not significantly affect patient delays. The predictors of patient delays or total PHDs were the same, irrespective of whether patients ignored symptoms, had a fear of getting a heart attack, and sought intermediate care.

ACKNOWLEDGEMENTS

We wish to acknowledge Vaughn Beepat, a medical student at the University of the West Indies, St. Augustine, who assisted in data collection, and Professor Terrence Seemungal for his constant support and encouragement.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee of South-West Regional Health Authority and the University of the West Indies

REFERENCES

1. ECC Committee, Subcommittees and Task Forces of the American Heart Association. 2005 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2005;112(24):201-3.
2. Ashraf VV, Maneesh M, Praveenkumar R, Saifudheen K, Girija AS. Factors delaying hospital arrival of patients with acute stroke. *Ann Indian Acad Neurol*. 2015;18(2):162-6.
3. Yu PN. Prehospital care of acute myocardial infarction. *Circulation*. 1972;45(1):189-204.
4. Lwanga SK, Lemeshow S. Sample size determination in health studies: A practical manual. World Health Organization; Geneva, 1991. Available at [http://apps.who.int/iris/bitstream/10665/40062/1/9241544058_\(p1-p22\).pdf](http://apps.who.int/iris/bitstream/10665/40062/1/9241544058_(p1-p22).pdf). Accessed 30 December 2015.
5. Zerwic JJ. Patient delay in seeking treatment for acute myocardial infarction symptoms. *J Cardiovasc Nurs*. 1999;13(3):21-2.
6. Perkins-Porras L, Whitehead DL, Strike PC, Steptoe A. Pre-hospital delay in patients with acute coronary syndrome: factors associated with patient decision time and home-to-hospital delay. *Eur J Cardiovasc Nurs*. 2009;8(1):26-3.
7. Republic of Trinidad and Tobago Ministry of Health Annual Statistical Report, 2004-2005. Available at www.health.gov.tt/downloads/DownloadItem.aspx?id=48. Accessed on 30 December 2015.
8. Wu JR, Moser DK, Riegel B, McKinley S, Doering LV. Impact of prehospital delay in treatment seeking on in-hospital complications after acute myocardial infarction. *J Cardiovasc Nurs*. 2011;26(3):184-93.
9. Kumar A, Cannon CP. Acute Coronary Syndromes: Diagnosis and Management, Part I. *Mayo Clinic Proc*. 2009;84(10):917-38.
10. Martín-Timón I, Sevillano-Collantes C, Segura-Galindo A, del Cañizo-Gómez FJ. Type 2 diabetes and cardiovascular disease: Have all risk factors the same strength? *World J Diabetes*. 2014;5(4):444-70.
11. Li Y, Du T, Lewin MR, Wang H, Ji X, Zhang Y, et al. Circadian, day-of-week, and age patterns of the occurrence of acute coronary syndrome in Beijing's emergency medical services system. *Am J Emerg Med*. 2010;28(6):663-7.
12. Ekelund U, Akbarzadeh M, Khoshnood A, Björk J, Ohlsson M. Likelihood of acute coronary syndrome in emergency department chest pain patients varies with time of presentation. *BMC Res Notes*. 2012;5(1):420.
13. Henriksson C, Lindahl B, Larsson M. Patients' and relatives' thoughts and actions during and after symptom presentation for an acute myocardial infarction. *Eur J Cardiovasc Nurs*. 2007;6(4):280-6.
14. Horne R, James D, Petrie K, Weinman J, Vincent R. Patients' Interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction. *Heart*. 2000;83(4):388-93.
15. Ottesen MM, Diken U, Torp-Pedersen C, Køber L. Prehospital delay in acute coronary syndrome—an analysis of the components of delay. *Int J Cardiol*. 2004;96(1):97-103.
16. Herlitz J, WireklintSundström B, Bång A, Berglund A, Svensson L, Blomstrand C. Early identification and delay to treatment in myocardial infarction and stroke: differences and similarities. *Scand J Trauma Resusc Emerg Med*. 2010;18(1):48.
17. Henriksson C, Larsson M, Arnetz J, Berglin-Jarlöv M, Herlitz J, Karlsson JE, et al. Knowledge and attitudes toward seeking medical care for AMI-Symptoms. *Int J Cardiol*. 2011;147(2):224-7.
18. McGinn AP, Rosamond WD, Goff DC, Taylor HA, Miles JS, Chambless L. Trends in pre-hospital delay time and use of emergency medical services for acute myocardial infarction: experience in 4 US communities from 1987-2000. *Am Heart J*. 2005;150(3):392-400.
19. Herlitz J, Bång A, Isaksson L, Karlsson T. Ambulance dispatchers' estimation of intensity of pain and presence of associated symptoms in relation to outcome in patients who call for an ambulance because of acute chest pain. *Eur Heart J*. 1995;16(12):1789-94.
20. Lambrew CT, Bowlby LJ, Rogers WJ, Chandra NC, Weaver WD. Factors influencing the time to thrombolysis in acute myocardial infarction. *Arch Intern Med*. 1997;157(22):2577-82.
21. De Luca G, Suryapranata H, Ottervanger JP, Antman EM. Time delay to treatment and mortality in primary angioplasty for acute myocardial infarction: every minute of delay counts. *Circulation*. 2004;109(10):1223-5.
22. Franzosi MG, Fresco C, Geraci E, Maggioni AP, Tavazzi L, Tognoni G, et al. Epidemiology of avoidable delay in the care of patients with acute myocardial infarction in Italy. A GISSI-generated

- study. GISS--Avoidable Delay Study Group. *Arch Intern Med*. 1995; 155(14):1481-8.
23. Boden H, van der Hoeven BL, Karalis I, Schalij MJ, Jukema JW. Management of acute coronary syndrome: achievements and goals still to pursue. Novel developments in diagnosis and treatment. *J Intern Med*. 2012;271(6):521-36.
24. Nallamothu BK, Bates ER, Herrin J, Wang Y, Bradley EH, Krumholz HM. Times to treatment in transfer patients undergoing primary percutaneous coronary intervention in the United States. *Circulation*. 2005;111(6):761-77.
25. McKee G, Mooney M, O'Donnell S, O'Brien F, Biddle MJ, Moser DK. Multivariate analysis of predictors of pre-hospital delay in acute coronary syndrome. *Int J Cardiol*. 2013;168(3):2706-13.
26. Heestermans T, van 't Hof AWJ, ten Berg JM, van Werkum JW, Boersma E, Mosterd A, et al. The golden hour of prehospital reperfusion with triple antiplatelet therapy: A sub-analysis from the Ongoing Tirofiban in Myocardial Evaluation 2 (On-TIME 2) trial early initiation of triple antiplatelet therapy. *Am Heart J*. 2010;160(6):1079-84.
27. Antman EM, Anbe DT, Armstrong PW, Bates ER, Green LA, Hand M, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction—executive summary. *Circulation*. 2004;110(5):588–636.

Cite this article as: Bahall MU, Legall G. Pre-hospital care in stable patients with acute coronary syndrome: Factors and predictors of pre-hospital delays in a tertiary public health institute. *Int J Community Med Public Health* 2018;5:12-20.