

Half of coronary patients are not instructed how to respond to symptoms of a heart attack

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Abstract

Background: *The delayed treatment of acute coronary syndrome has a significant impact on survival. Due to improved organization and the use of reperfusion therapies, in-hospital delay has been shortened in recent years. However, the time between the onset of chest pain and the call for medical help is still too long. The aim of this study was to assess the proportion of coronary patients instructed how to behave in case of chest pain and to find what factors relate to a lower probability of being counselled.*

Methods: *Patients aged < 80 years, hospitalized due to coronary artery disease (CAD) were identified retrospectively on the basis of a medical records review and were invited for a follow-up examination. Two hundred and nineteen patients agreed to participate in the study. Data on the prehospital delay was obtained using a standard questionnaire.*

Results: *The study group consisted of 149 men and 70 women. The mean time between discharge and the follow-up examination was 1.1 ± 0.4 years. Of 219 study participants, 106 (48.4%) declared they had been instructed about the symptoms of a heart attack and how to respond to it. Men, smokers, non-diabetics, and those with previously diagnosed CAD had been instructed more frequently. The independent predictors of being instructed were: percutaneous coronary intervention during the index hospitalization, diabetes, smoking, male sex and previously diagnosed CAD.*

Conclusions: *About half of patients after hospitalization due to CAD are not instructed how to respond to heart attack symptoms. This has not changed over the last decade and may contribute to the lack of shortening of prehospital delay. (Cardiol J 2011; 18, 6: 668–674)*

Key words: acute coronary syndrome, delay, education

Introduction

Individuals who experience the signs and symptoms of acute coronary syndrome (ACS) often delay seeking treatment. A delay of even only a few hours can have a significant impact on patient survival with a 30-minute delay reducing average life

expectancy by one year [1]. The delay in treatment administration can be divided into two phases: pre-hospital delay and in-hospital delay. Prehospital delay consists of decision time, i.e. the interval between onset of symptoms and the patient's decision to seek help, and transport time [2]. Up to three quarters of the time related to prehospital delay in

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ACS is the result of patient's failure to call the emergency medical services [3–5]. Among patients who die within one year of the onset of acute myocardial infarction (AMI) symptoms, most die before accessing a healthcare facility [6–8]. This high initial mortality seems to have altered little over recent years, in contrast to hospital mortality [9]. Due to improved organization and the wider use of reperfusion therapies, in-hospital delay has been shortened and in-hospital mortality reduced. However, the time between the onset of chest pain and the call for medical help is still too long.

The complex cognitive, social and emotional processes involved in identifying ACS symptoms correctly and seeking care immediately are recognized nowadays. Health professionals play an important role in reducing treatment delay, including delay in seeking medical care. Recommendations from the National Heart Attack Alert Program target specific groups of patients: those who are known to have coronary heart disease, atherosclerotic disease of the aorta or peripheral arteries, or cerebrovascular disease, because they have a five to seven times greater risk for AMI or death than do the general population [10]. The experts recommend that these high-risk patients should be clearly informed about the symptoms of AMI, the steps that they should take and the importance of contacting emergency medical services [10]. Unfortunately, it seems that physicians rarely advise patients about how to respond to chest pain [4, 11]. Therefore, the aim of this study was to assess the proportion of coronary patients counselled on how to behave in cases of chest pain, as well as to find what factors relate to a lower probability of being counselled.

Methods

The present study is a subanalysis of the Polish part of EUROASPIRE III survey data [12–14]. The studied group and the methods used have been described in earlier reports [12–14]. Briefly, consecutive patients aged < 80 years, hospitalized (between April 1, 2005 and July 31, 2006) in five Krakow hospitals due to coronary artery disease (CAD) (AMI, unstable angina, percutaneous coronary intervention [PCI] or qualification for coronary artery bypass surgery) were identified retrospectively on the basis of a medical records review and were then invited to take part in a follow-up examination six to 18 months after discharge. Two hundred and nineteen patients agreed to participate in the present substudy.

Data on demographic characteristics, personal history of CAD, risk factors, and the prehospital de-

lay were obtained using a standard questionnaire. Patients were asked if they had been instructed how to respond to symptoms of a heart attack during index hospitalization or during the post-discharge period (it was sufficient to fulfil the criterion of being instructed if a patient had been instructed at least once during index hospitalization or during the post-discharge period). Previous CAD was defined as myocardial infarction, hospitalization due to unstable angina, revascularization procedure or stable angina prior to the index event. Finally, we compared the present data with the data from the Cracovian Program for Secondary Prevention of Ischemic Heart Disease database [4]. The Cracovian Program was conducted in 1997 and 1998 and focused on coronary patients hospitalized in 1996 and 1997 [15, 16]. The comparison is possible because we used the same methods as in the first survey, with the exception of age [4, 15, 16]. Therefore, when we compared data from the previous and present surveys we excluded patients aged over 70 years from the present survey database.

The study protocol was approved by the Bioethics Committee of the Jagiellonian University (KBET/115/B/2005).

Statistical analysis

Categorical variables are reported as proportions and continuous variables as means \pm standard deviation (with exception for delay times which are reported as median [interquartile interval] due to significantly skewed distribution). The Pearson χ^2 test was applied to all categorical variables. Normally distributed continuous variables were compared using the Student's t test. Variables without normal distributions were evaluated using the Mann-Whitney U test. A two-tailed p value of less than 0.05 was considered to indicate statistical significance. A stepwise multivariate analysis, consisting of a logistic regression was performed with the use of all variables. Items with the highest p values were sequentially removed and a new logistic model was defined without the eliminated variable. This operation was continued until all remaining variables had p values of less than 0.05.

Results

The study group consisted of 149 men and 70 women. Women were older and less frequently active professionally when compared with men (Table 1). The mean time between discharge and the follow-up examination was 1.1 ± 0.4 years and did not differ significantly between sexes. A possi-

Table 1. Characteristics of the study participants.

Variable	Men (n = 149)	Women (n = 70)	P	Total (n = 219)
Age [years ± SD]	59.5 ± 9.3	62.4 ± 8.9	0.03	60.4 ± 9.3
Mean duration of education [years ± SD]	11.5 ± 3.3	10.5 ± 2.9	0.04	11.2 ± 3.2
Active professionally [%]	38	21	0.02	32
Hospitalization due to ACS [%]	85	86	0.93	85
Coronary artery disease diagnosed previously*	49	44	0.52	47
Hypertension [%]	80	84	0.50	81
Hypercholesterolemia [%]	93	92	0.85	92
Smoking [%]	28	16	0.05	24
Diabetes [%]	23	30	0.30	26
Obesity [%]	31	37	0.34	32
Mean time between the index hospitalization and follow-up examination [years ± SD]	1.1 ± 0.4	1.0 ± 0.3	0.29	1.1 ± 0.4

*Before the index hospitalization; ACS — acute coronary syndrome; SD — standard deviation

ble selection bias in the formation of this study population was examined by comparing it with respect to age, sex, education, risk factors, the mean time between discharge and the follow-up examination and the type of physician (general practitioner *vs* cardiologist) with data of patients who did not agree to participate in the present substudy. These comparisons did not show any statistically significant differences with respect to all the above factors except for sex (75% men in responders *vs* 61% in non-responders; $p < 0.05$).

Of 219 study participants, 106 (48.4%) declared that they had been instructed about the symptoms of a heart attack and how to respond to it (Table 2). Men, smokers, non-diabetics, and those with previously diagnosed CAD had been instructed more frequently. The independent predictors of being instructed were: PCI during the index hospitalization, diabetes, smoking, sex, and previously (i.e. before the index hospitalization) diagnosed CAD (Table 3). Among instructed subjects, 92 (86.8%) were advised by a physician, the others by a nurse or another member of medical staff. Additionally, printed materials (leaflets, booklets) were given to 15 (14.2%) subjects.

Among 187 patients hospitalized due to ACS, the mean total prehospital delay (from symptoms onset to arrival to hospital) was 12.5 ± 33.8 h (from 0.25 h to 240.5 h); the delay from symptoms onset to the call for emergency services (or appearing at the emergency department or primary care physician) was 11.7 ± 33.7 h (from 1 min to 240.0 h); the delay from the call to the arrival of the ambulance (or from appearing at the emergency department or primary care physician to contact with a physician) was 0.37 ± 0.84 h (from 2 min to 8.5 h); and

Table 2. Proportions of patients being counselled about how to respond to symptoms of a heart attack.

Subgroup	Proportion of instructed patients [%]	P
Age ≤ 60 years	50	0.52
Age > 60 years	46	
Men	54	0.02
Women	37	
Mean duration of education ≤ 11 years	48	0.89
Mean duration of education > 11 years	49	
Professionally active	48	0.92
Professionally inactive	49	
Myocardial infarction	51	0.07
Unstable angina	58	
PCI	36	
CABG	50	0.85
ACS	49	
No ACS	47	
Previous CAD	59	< 0.01
No previous CAD	39	
Smoking	60	0.03
No smoking	44	
Hypertension	48	0.85
No hypertension	50	
Hypercholesterolemia	48	0.99
No hypercholesterolemia	48	
Diabetes	35	0.04
No diabetes	52	
Total	48	

PCI — percutaneous coronary intervention; CABG — coronary artery bypass surgery; ACS — acute coronary syndrome; CAD — coronary artery disease

Table 3. Independent predictors of being instructed about the symptoms of a heart attack and how to respond to it.

Variable	Odds ratio (95% CI)
PCI	0.42 (0.22–0.80)
Diabetes	0.45 (0.22–0.94)
Male sex	1.97 (1.05–3.70)
Smoking	2.08 (1.08–4.00)
Previous CAD	2.30 (1.29–4.10)

PCI — percutaneous coronary intervention; CAD — coronary artery disease; CI — confidence interval

the delay from arrival of the ambulance to the patient's home to arrival to the hospital was 0.30 ± 0.47 h (from 2 min to 5.0 h). The median values, along with interquartile intervals of each time, are presented in Table 4. The delay from the onset of

symptoms to the call for emergency services as well as the total delay were significantly longer in patients without previously (before the index hospitalization) diagnosed CAD.

Table 5 presents the proportions of patients calling the emergency service, obtaining help, and being transported to the hospital within one hour, four hours, and twelve hours from the onset of symptoms. During the first hour, 59% of subjects called the emergency service or came to the emergency department or primary care physician and 39% arrived at hospital.

Finally, we compared the present data with the data from the Cracovian Program for Secondary Prevention of Ischemic Heart Disease database [4]. This allowed for the assessment of the time trend over the decade (Fig. 1). We found no significant difference between 1996/97 and 2006/07.

Table 4. The delay from the onset of symptoms to the call for emergency services (or coming to the emergency department or primary care physician), the delay related to awaiting the emergency service (or awaiting a physician in an emergency department or a local clinic), and the delay related to transport to hospital in patients with acute coronary syndrome.

Period	Previous CAD	No previous CAD	P	All patients
	Median value (lower quartile–upper quartile)			
From the onset of symptoms to call for emergency service [h]	0.50 (0.25–2.00)	1.00 (0.50–5.00)	< 0.01	0.83 (0.33–4.00)
Waiting for emergency service [h]	0.25 (0.25–0.42)	0.25 (0.17–0.33)	1.00	0.25 (0.17–0.33)
Transport to hospital [h]	0.25 (0.17–0.42)	0.33 (0.25–0.42)	0.26	0.33 (0.25–0.42)
Total prehospital delay [h]	1.00 (0.67–2.71)	2.00 (0.93–5.67)	< 0.01	1.50 (0.75–4.80)

Table 5. Proportions of patients with acute coronary syndrome calling the emergency service (or coming to the emergency department or primary care physician), obtaining help, and being transported to hospital within one hour, four hours, and twelve hours of the onset of symptoms.

Period	To the call for emergency service	To the arrival of emergency service*	To arrival to hospital
Patients with previous CAD:			
≤ 1 hour [%]	71**	59**	50**
≤ 4 hours [%]	83	81	80**
≤ 12 hours [%]	88	87	86
Patients without previous CAD:			
≤ 1 hour [%]	50	40	30
≤ 4 hours [%]	73	70	66
≤ 12 hours [%]	85	84	83
All patients:			
≤ 1 hour [%]	59	49	39
≤ 4 hours [%]	77	75	72
≤ 12 hours [%]	87	86	85

*Or until contact with physician if the patient came to the emergency department or primary care physician by himself; **p < 0.05 vs patients without previous coronary artery disease (CAD)

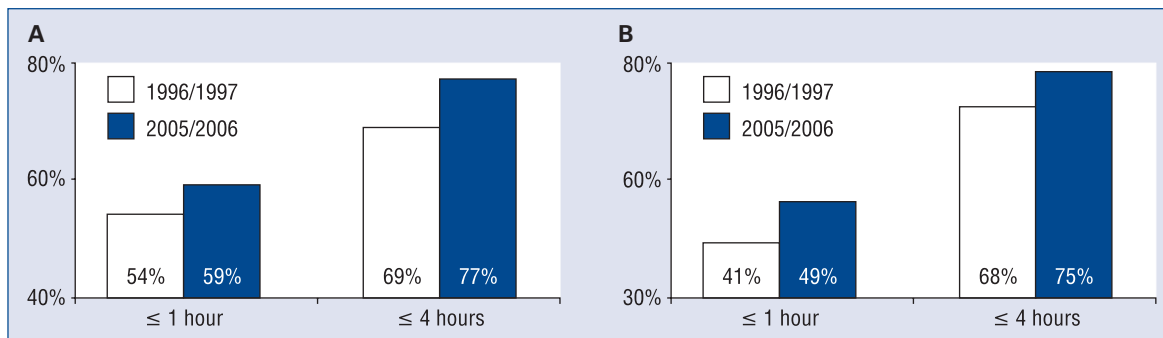


Figure 1. A. Proportions of patients with acute coronary syndrome calling the emergency service (or coming to the emergency department or primary care physician) within one and four hours of the onset of symptoms; **B.** Proportions of patients with acute coronary syndrome obtaining help within one and four hours of the onset of symptoms.

Discussion

In the authors' opinion, the most important finding of the present study is that only about half of coronary patients are instructed on how to behave when chest pain occurs, and this figure has not changed since the 1990s [4]. Subjects with coronary heart disease are at high risk for myocardial infarction or death [10]. About 50% of all AMIs, and at least 70% of deaths from CAD, occur in persons who have had a previous manifestation of cardiovascular disease [10]. Eight to 10% of post-infarction patients have a recurrent infarction within a year of discharge, and mortality after discharge remains much higher than in the general population [1]. Correct advice on how to respond to the symptoms of a heart attack reduces prehospital delay significantly [4]. It seems that prehospital delay could be significantly reduced in Poland if all patients with CAD were to be instructed properly. This may require involving highly educated nurses.

Our results are in accordance with other Polish studies [17]. Among the inhabitants of Warsaw, a general practitioner was mentioned as a source of information by 44.4% of patients and a nurse by 11.5% [17]. Only half of patients treated for CAD knew what AMI was and what the characteristic features of coronary pain were [17]. Another study showed that only 31% of myocardial infarction survivors declare being advised by a physician about how to respond to chest pain [11]. These studies point to a need for more intensive education of patients with high cardiovascular risk. Health professionals should pay attention to this issue. They may also use additional sources of information, for example brochures. In a Polish study conducted in 157 consecutive patients hospitalized due to AMI, the use of educational brochures led to a significant

increase of knowledge in this group [18]. However, it should be underlined that one-to-one intervention is the most effective.

An important factor influencing the delay is the individual's knowledge of potential treatment options. Walkiewicz et al. [17] showed that ACS patients with a poor level of knowledge about AMI, risk factors and management of AMI call emergency services later. In the last decades most interventions to improve the awareness of AMI and reduce prehospital delay in patients with chest pain have targeted the general population using mass media campaigns and have been shown to be of limited effectiveness [19]. A possible explanation for the ineffectiveness of such interventions is that mass media campaigns focus on increasing the public's knowledge, but do not address individuals. Indeed, the concept of denial and indecision is commonly used to explain delay [20]. Indecision is defined as not knowing what to do and constructing and weighing options before taking action. The natural coping response to indecision is waiting. Unfortunately, media campaigns are usually not effective in overcoming denial or indecision. The decision to seek treatment is heavily influenced by patients' social context, cognitive processes, and emotional reactions, but these aspects of delay remain underexplored. Nevertheless, health professionals, and especially physicians, could play an important role in this area.

It seems that the only effective solution is one-to-one professional counselling which is not necessarily provided by physicians, but can be provided by highly educated nurses. Unfortunately, although some European as well as American guidelines recommend that it should be a normal part of the care of patients with known coronary heart disease to inform them and their family about the symptoms

of a heart attack and how to respond to it [1, 10], not all guidelines support this view [21]. This may induce some confusion.

While outcomes of mass media interventions are discouraging, it seems that patients may benefit more from individual intervention [19]. A previous study reporting the effect of an individual education and intervention on knowledge, attitudes and beliefs about AMI symptoms and the appropriate response to symptoms in people with known CAD showed that one-to-one intervention resulted in improved knowledge of CAD, AMI symptoms and the appropriate response to symptoms in people at risk [22]. A recently published randomized study failed to show the effectiveness of one-to-one intervention, probably due to some form of intervention provided in the control arm [23].

In our study, men, smokers, and non-diabetics were instructed more frequently. Our results agree with the previous studies which have reported that female sex, age, diabetes, and hypertension are related to longer prehospital delay [4, 24, 25]. This suggests that intervention aimed at shortening prehospital delay should place more emphasis on these subgroups. Improving patient responsiveness in these subgroups represents an important opportunity to improve quality of care and minimize disparities in care. One possible reason for longer delay in women is that they have different symptoms to men, and physicians have to be aware of this [26].

We showed that delay from the onset of symptoms to the call for emergency services, as well as the total delay, were significantly shorter in patients with recurrent CAD. Probably, patients with recurrent coronary events are more educated about symptoms, and therefore do not wait so long before making the decision to call emergency services.

Limitations of the study

It should be underlined that this study has some limitations. We did not analyze knowledge about ACS and their symptoms. The analyzed data was obtained during follow-up examination six to 18 months after discharge. Therefore, it is possible that more patients were educated during and after the index hospitalization about how to respond to chest pain and that some study participants had forgotten about the counselling. Nevertheless, this would lead to the conclusion that the counselling was not effective in this subgroup. Moreover, patients should also be counselled after discharge. Unfortunately, it seems that physicians working in outpatient clinics, as well as general practitioners, do not provide adequate counselling. As the delay

times were based on the patients' interview, they might be influenced by the fact that we were unable to interview those who hadn't survived until the interview. One may expect a higher risk of death in those not instructed. Thus, the possible overestimation of the proportion of counselled patients should be taken into account. Finally, we realize that declarations of the respondents may not necessarily reflect their real actions, and it is possible that fewer people would in fact act properly when faced with myocardial infarction symptoms. On the other hand, a significant strength of the study is its direct, face-to-face method of interviewing the patients. This excludes the potential influence of other factors, such as help from someone else or use of other materials, on the answers of respondents. It should also be mentioned that a prospective registry would probably provide more accurate data.

Conclusions

About half of patients, following hospitalization due to CAD, are not instructed how to respond to the symptoms of a heart attack. This figure has not changed for the past decade, and may contribute to the observed lack of shortening of the patient-related pre-hospital delay.

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References

1. Van de Werf F, Bax J, Betriu A et al. Management of acute myocardial infarction in patients presenting with persistent ST-segment elevation. *Eur Heart J*, 2008; 29: 2909–2945.
2. Finn CJ, Bett JHN, Shilton TR, Cunningham C, Thompson PL. Patient delay in responding to symptoms of possible heart attack: Can we reduce time to care? *MJA*, 2007; 187: 293–298.
3. Perkins-Porras L, Whitehead DL, Strike PC, Steptoe A. Pre-hospital delay in patients with acute coronary syndrome: Factors associated with patients' decision time and home-to-hospital delay. *Eur J Cardiovasc Nurs*, 2009; 8: 26–33.
4. Pająk A, Jankowski P, Dojka E, Kawecka-Jaszcz K. Instruction of patients and a delay of treatment in myocardial infarction and unstable angina in the Krakow Program of Secondary Prevention of Ischaemic Heart Disease (IHD). *Przegl Lek*, 2001; 58: 903–907.
5. Rasmussen CH, Munck A, Kragstrup J, Haghfelt T. Patient delay from onset of chest pain suggesting acute coronary syndrome to hospital admission. *Scand Cardiovasc J*, 2003; 37: 183–186.
6. Broda G, Rywik S, Kurjata P. Opieka szpitalna nad chorym z zawałem serca w latach 1986–1992. Program POL-MONICA Warszawa. *Kardiologia Pol*, 1996; 44: 482–492.

7. Pająk A, Jamrozik K, Kawalec E et al. Myocardial infarction: Risks and procedures. Longitudinal observation of a population of 280,000 women and men. Project POL-MONICA Krakow. III: Epidemiology and treatment of myocardial infarction. *Przegl Lek*, 1996; 53: 767–778.
8. Khraim FM, Carey MG. Predictors of pre-hospital delay among patients with acute myocardial infarction. *Patient Educ Couns*, 2009; 75: 155–161.
9. Goldberg RJ, Glatfelter K, Burbank-Schmidt E, Lessard D, Gore JM. Trends in community mortality due to coronary heart disease. *Am Heart J* 2006;151: 501–507.
10. Dracup K, Alonzo AA, Atkins JM et al. The physician's role in minimizing prehospital delay in patients at high risk for acute myocardial infarction: Recommendations from the National Heart Attack Alert Program. *Ann Intern Med*, 1997; 126: 645–651.
11. Kopec G, Sobien B, Podolec M 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*, 2010 [Epub ahead of print].
12. Kotseva K, Wood D, De Backer GD et al. The EUROASPIRE Study Group. EUROASPIRE III: A survey on the lifestyle, risk factors and use of cardioprotective drug therapies in coronary patients from 22 European countries. *EJCPR*, 2009; 16: 121–137.
13. Jankowski P, Kawecka-Jaszcz K, Pająk A et al. Secondary prevention of coronary artery disease in hospital practice over the decade 1996–2006. Results of Cracovian Program for Secondary Prevention of Ischaemic Heart Disease and Polish parts of EuroASPIRE II and EuroASPIRE III surveys. *Kardiologia Pol*, 2009; 67: 970–976.
14. Pająk A, Jankowski P, Kawecka-Jaszcz K et al. Changes in secondary prevention of coronary artery disease in the post-discharge period over the decade 1997–2007. Comparison of Cracovian Program for Secondary Prevention of Ischaemic Heart Disease and Polish parts of EUROASPIRE II and EUROASPIRE III surveys. *Kardiologia Pol*, 2009; 67: 1353–1359.
15. Kawecka-Jaszcz K, Jankowski P, Pająk A et al. Cracovian program for secondary prevention of ischaemic heart disease. Part II: Secondary prevention of ischaemic heart disease during hospitalisation. *Przegl Lek*, 2001; 58: 956–963.
16. Kawecka-Jaszcz K, Jankowski P, Pająk A et al. Cracovian program for secondary prevention of ischaemic heart disease. Part III: Secondary prevention of ischaemic heart disease after discharge. *Przegl Lek*, 2001; 58: 964–968.
17. Walkiewicz M, Krówczyńska D, Kuchta U, Kmiecicka M, Kurjata P, Stepińska J. Acute coronary syndrome: How to reduce the time from the onset of chest pain to treatment? *Kardiologia Pol*, 2008; 66: 1163–1170.
18. Kubica A, Magielski P, Olejarczyk E et al. Źródła wiedzy a skuteczność edukacji zdrowotnej u osób z ostrym zawałem serca. *Folia Cardiol Excerpta*, 2009; 4: 285–290.
19. Jankowski P, Bednarek A, Kawecka-Jaszcz K. The influence of educational media campaigns on reduction of prehospital delay in patients with acute coronary syndrome: A systematic review. *Kardiologia Pol*, 2010; 68: 332–338.
20. Moser DK, Kimble LP, Alberts MJ 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; 114:168–182.
21. Graham I, Atar D, Borch-Johnsen K et al. European guidelines on cardiovascular disease prevention in clinical practice. Fourth Joint Task Force of the European Society of Cardiology and other societies on cardiovascular disease prevention in clinical practice (constituted by representatives of nine societies and by invited experts). *Eur J Cardiovasc Prev Rehabil*, 2007; 14 (suppl. 2): S1–S113.
22. Buckley T, McKinley S, Gallagher R, Dracup K, Moser DK, Aitken LM. The effect of education and counseling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. *Eur J Cardiovasc Nurs*, 2007; 6: 105–111.
23. Dracup K, McKinley S, Riegel B et al. A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome. *Circ Cardiovasc Qual Outcomes*, 2009; 2: 524–532.
24. Yarzebski J, Goldberg RJ, Gore JM, Alpert JS. Temporal trends and factors associated with extent of delay to hospital arrival in patients with acute myocardial infarction: The Worcester Heart Attack Study. *Am Heart J*, 1994; 128: 255–263.
25. Nguyen HL, Saczynski JS, Gore JM, Goldberg RJ. Age and sex differences in duration of prehospital delay in patients with acute myocardial infarction: A systematic review. *Circ Cardiovasc Qual Outcomes*, 2010; 3: 82–92.
26. El-Menyar A, Zubaid M, Rashed W et al. Comparison of men and women with acute coronary syndrome in six Middle Eastern countries. *Am J Cardiol*, 2009; 104: 1018–1022.