The effects of public education through Short Message Service on the time from symptom onset to hospital arrival in patients with myocardial infarction: A field trial

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Original Article

Abstract

BACKGROUND: Patients' early hospital arrival is among the most important factors in minimizing the complications of myocardial infarction (MI). One of the measures which can reduce prehospital delay in these patients is public education. The aim of the present study was to investigate the effects of public education through Short Message Service (SMS) on the time from symptom onset to hospital arrival (or onset-to-door time) in patients with MI in Kashan, Iran.

METHODS: This field trial was done on 131 patients with definite diagnosis of myocardial infarction. Intervention included sending an educational short message about the symptoms of MI and the necessity of referring to hospital immediately. Logistic regression analysis was performed to evaluate the predictors of the onset-to-door time.

RESULTS: The results showed no significant difference in demographic characteristics, clinical variables and past medical history between the participants in the two groups. The onset-to-door time was significantly shorter in the intervention group than the control group (240.53 ± 156.60 vs. 291.70 ± 251.23, P= 0.003). Moreover, the onset-to-call time was significantly shorter in the intervention group than the control group (127.06 ± 202.62 vs. 44.32 ± 81.26, P = 0.002). The odds of arrival at hospital in the first 120 minutes after the onset of MI manifestations was 5.8 (2.04-16.8) times higher in the group that received the educational SMS.

CONCLUSION: As both the onset-to-door and onset-to-call times were shorter in the intervention group, it is suggested to use this method to raise the public awareness of MI symptoms and the need for early referral.

Keywords: Emergency Medical Services, Myocardial Infarction, Short Message Service

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Introduction

Myocardial infarction (MI) is the most common life-threatening condition worldwide.[1] More than half of all cardiac deaths happen in the first thirty minutes after symptom onset, when the patient has not arrived at hospital settings.[2] Reducing the time from symptom onset to hospital arrival (onset-to-door time) is of great importance and any delay is associated with adverse outcomes.[3,4]

In earlier studies in Kashan, Iran, the mean onset-to-door was about 240.44 minutes[5] and 65.5% of these patients had a delayed onset-to-door time of eight hours or more.[6] Other studies conducted in Turkey,[7] South Korea,[8] and India[9] also reported an onset-to-door time of 70 minutes, 150 minutes, and more than four hours, respectively.

Public education about the symptoms of MI is critically important in reducing prehospital delay among patients experiencing MI.[5,10,11]

A number of public education methods have previously been used.[12-14] The Short Message Service (SMS) has been shown to be effective in patient education,[15] reminding patients of their medical appointments,[16] promoting their treatment adherence,[17] improvements in heart failure self-management,[18] improvements in health outcomes for chronic disease,[19] managing patients with contagious diseases,[20] and smoking cessation.[21,22] However, despite the evidences about the effectiveness of SMS in patient education, this method was mostly used in small groups of patients but not on the general population. Some of the studies have also reported that it had no significant effect on patient delay.[23,24] Moreover, to the best of our knowledge, no studies are available about the effect of SMS-based education on the onset-to-door

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time among patients with MI. Therefore, the present study was conducted to investigate the effects of SMS-based educations on the time from symptom onset to hospital arrival in patients with MI.

Materials and Methods

A filed trial was conducted on the general population of Kashan in a six-month period (from September 22, 2013 to March 20, 2014). The study was performed in two phases. Inclusion criteria were being diagnosed with MI by an attending cardiologist, and living in Kashan. The first phase of the study lasted for three months and there was no intervention. In this phase 106 patients were eligible and were considered as the control group. The second phase was performed in the second trimester of the study and the study intervention was performed. In this phase, a text message was send to the general population and all those who had an MI and had received the text message (by them-selves or by one of the family members) were considered as the experimental group. A total of 25 patients were eligible in this phase and were considered as the experimental group. Finally, we selected a total of 131 patients with MI (106 patients in control group and 25 patients in experimental group).

At the beginning of the second phase, we sent a short educational message twice (with a one-week interval) to all residents of Kashan whose cellphone number was retrievable from the Kashan Telecommunication Center. The educational short message was about the symptoms of myocardial infarction and the necessity of referring to hospital immediately or call 115. The content of the message was in Persian, as follows "Chest pain, cold sweats, nausea, vomiting, and shortness of breath can be the symptoms of heart problems. Once occurred, immediately transfer the patient to a hospital or call 115. [i.e. the Emergency Medical System (EMS)]" This short message was sent to 42000 people twice, resulting in 84000 messages in total. In this phase, data was collected after sending the second message.

The data collection was conducted in two phases (i.e. three months before and three months after the intervention). An expert nurse researcher who was previously trained for the purpose of this study collected the data. The data collection was started after obtaining ethical approval from the Ethics Committee of Kashan University of Medical Sciences. During the aforementioned period and on a daily basis, the researcher referred to the emergency department and the coronary care unit (CCU) of the Kashan Shahid Beheshti Hospital to identify the eligible patients.

In the second day of hospitalization, the researcher reassessed the patients' medical records and interviewed the patients if they were clinically and hemodynamically stable. If a patient was not able to answer the interview questions, we interviewed his/her companion. A total of 131 eligible patients were recruited in the study.

A three-part researcher-made questionnaire was employed for data collection. The first part was on participants' demographic characteristics including age, gender, smoking, income (sufficient/insufficient), education level, marital and employment status, place of residence, place and time of symptom onset, and the first manifestation of MI. The second part of the questionnaire included items on history of hypertension, diabetes mellitus, hyperlipidemia, cardiac failure, chest pain, MI, and angiography as well as history of MI among first-degree relatives. The third part also dealt with time from symptom onset to call for help (onset-to-call time) and time from call for help to hospital arrival (call-to-door time). This questionnaire was developed through literature review. The content validity of the questionnaire was evaluated by a panel of ten nursing faculty members and cardiologists affiliated to Kashan University of Medical Sciences. The experts were asked to evaluate each question in terms of its simplicity, relevancy and clarity. Then, the overall content validity index (CVI) was calculated as 0.85 and for each question as 0.81-0.95. The reliability of the third part of the questionnaire was evaluated through examining the correlation of call-to-onset and call-to-door times reported by two raters (i.e. patients and their family members) which resulted in an inter-rater correlation coefficient of 0.91.

The collected data were analyzed via SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics such as mean, standard deviation, and frequencies were calculated. The Kolmogorov-Smirnov test was done to assess the normality of the study variables. Between-group comparisons were done by conducting the independent sample t-test (for normal variables) and the Mann-Whitney U test (for variables with non-normal distribution). Categorical data were analyzed using the Fisher's exact and the chi-square tests. The cut-off point for the onset-to-door time was ≤ 120 minutes.[25] Besides, we performed univariate analysis to identify factors contributing to onset-to-door time including gender, income, marital status, receiving short message, chest pain, place of residence, and history of hypertension and diabetes mellitus.

Table 1. The participants' clinical characteristics and past medical history

Variables		Group*		P
		Control (n = 106)	Experimental (n = 25)	
Hypertension	Yes	50 (47)	12 (48)	0.940‡
Diabetes	Yes	29 (27)	7 (28)	0.950‡
Hyperlipidemia	Yes	42 (40)	9 (36)	0.740‡
Chest pain	Yes	38 (36)	9 (36)	0.990‡
MI	Yes	17 (16)	3 (12)	0.760†
History of MI among first-degree relatives	Yes	42 (40)	14 (56)	0.140‡
Receiving treatments for heart problems	Yes	23 (22)	4 (16)	0.780†
Pain severity	Sever to very sever	75 (71)	20 (80)	0.350‡
Heart failure	Yes	10 (9)	1 (4)	0.690†
History of angiography	Yes	18 (17)	4 (12)	0.990†
Onset-to-door time	≤ 120 minutes	43 (41)	20 (80)	0.001‡
Transferring with an EMS ambulance	Yes	58 (55)	15 (60)	0.440‡

* Data presented as [n (%)]; † The results of the Fisher's exact test; ‡ The results of the chi-square test
MI: Myocardial infarction; EMS: Emergency Medical Services

Then, the logistic regression analysis was performed to evaluate the predictors of the onset-to-door time. Accordingly, all factors with a P-value less than 0.5 were entered into the logistic regression model. Moreover, analysis of covariance was performed to examine the effects of confounding factors on the onset-to-call, call-to-door and onset-to-door times. The level of significance in all tests was set at below 0.05.

Results

Totally, 131 patients were studied in the control (n = 106) and experimental (n = 25) group. The mean age of the control and the experimental groups were 63.79 ± 12.16 and 59.00 ± 13.63 years, respectively (P = 0.860). In the control and the experimental groups, 84% and 85.9% of the patients had lower-diploma (P = 0.530), 73.6% and 84% were male (P = 0.280), 88% and 90.6% were married (P = 0.700), 32% and 31.1% were employed (P = 0.970), 76% and 79.2% were non-smokers (P = 38), and 96% and 84% experienced MI at home (P = 0.230), 94.3% and 84% had sufficient income, 96.2% and 96% were insured, and 81.2% and 96% lived in Kashan, respectively. Furthermore, no significant difference was found between the two groups regarding other clinical variables and their past medical history (Table 1).

Table 2 shows the onset-to-call, call-to-door, and onset-to-door times. The study groups differed significantly from each other regarding the onset-to-call and the onset-to-door times (P = 0.002 and 0.003, respectively). In analysis of covariance, the onset-to-call, and onset-to-door times were considered as dependent variables, SMS reception as fix factor, and other variables as covariates. No variable other than SMS reception had a significant effect on these times. The same procedure was conducted for the call-to-door time and no variable had a significant effect.

In univariate analysis, the onset-to-door time was significantly correlated only with receiving or not receiving short message (P = 0.001, Table 3). Furthermore, the logistic regression analysis illustrated that receiving short message was the only significant predictor of the onset-to-door time [Odds ratio = 5.86 (2.04-16.8), P = 0.001, Table 4].

Table 2. The means of the onset-to-door times

Time	Control group (n = 106)			Experimental group (n = 25)			P
	Mean ± SD (min)	Median	IQR	Mean ± SD (min)	Median	IQR	
Onset-to-call time	127.06 ± 202.62	60.0	100	44.32 ± 81.26	20	35	0.002*
Call-to-door time	125.43 ± 204.14	70.5	60	114.92 ± 185.73	66	47	0.436
Onset-to-door time	291.70 ± 251.23	148.0	205	240.53 ± 156.60	91	65	0.003

* Mann-Whitney U test
IQR: Interquartile range; SD: Standard deviation

Table 3. Univariate analysis based on predicting factors of the time from call for help to hospital arrival*

Variables		Onset-to-door*		P
		≤ 120 min (n = 63)	> 120 min (n = 68)	
Gender	Male	50 (79.4)	49 (72.1)	0.330§
Income†	Sufficient	56 (88.9)	65 (95.6)	0.190‡
Marital status	Married	55 (87.3)	63 (92.6)	0.310§
Receiving short message	Yes	20 (31.7)	5 (7.40)	0.001§
History of chest pain	Yes	11 (26.2)	36 (40.4)	0.830§
Place of residence	Kashan	22 (34.9)	54 (79.4)	0.080§
	Suburb of Kashan	41 (65.1)	14 (20.6)	
History of diabetes mellitus	Yes	17 (27.0)	19 (27.9)	0.900§
History of hypertension	Yes	26 (41.3)	36 (52.9)	0.180§

* All data presented as [n (%)]; † Considering view of patients, their income was enough for their expenditures; ‡ The results of the Fisher's exact test; § The results of the chi-square test

Discussion

The findings of the study showed that the mean of the onset-to-call and the onset-to-door times decreased significantly in the patients who had received the short message. However, the call-to-door time did not significantly differ between the two groups. On the other hand, in the present study, no significant difference was found between the two groups in terms of transferring with an EMS ambulance. These findings revealed positive effect of the intervention and weak performance of the EMS system.

In this study, the onset-to-call time was 4.89 times shorter in the experimental group than the control group. However, the call-to-door time was only 1.21 time shorter in this group. The onset-to-call time directly reflects the patients' performance and the positive effect of SMS on their treatment seeking behavior trough calling the EMS. However, the onset-to-door time is influenced by both the patients and the EMS performance. Considering the insignificant difference between the two groups in terms of the call-to-door time, and that this time is a direct reflection of the performance of the EMS, we can conclude that the intervention had positively affected the patients' treatment seeking behavior and decreased their delay in calling the EMS, but the performance of the EMS system remained unchanged. The insignificant difference of the two groups in terms of using the EMS ambulances can also confirm this interpretation and shows that the long delay of the EMS eventually made some of the patients to use personal transportation vehicles for referring to the hospital. Although a study in England has reported that public education was not effective on decreasing the onset-to-call delay and on the use of EMS,[26] the findings of the present study are consistent with a study conducted in Geneva, which reported that a public campaign was associated with a significant decrease in prehospital delay from 196 to 144 minutes.[27] Luepker et al. also found that after an eighteen-months media-based education, the use of EMS increased significantly; however, the prehospital delay did not significantly change.[28] Wright et al. have also found that a community-based education could increase the use of EMS and the presence of patients with chest pain and MI in the emergency room and decrease the onset-to-door time, however, the differences between the groups were not statistically significant.[29]

The results of the aforementioned studies imply that although education might decrease the patients' delay in calling the EMS, the outcome might be different depending on the performance of the health care system including the prehospital EMS.[27]

In the present study, no significant difference was found between the two groups in terms of transferring with an EMS ambulance. This finding might also be attributed to the weak performance of the EMS system despite the improvement in the peoples' treatment seeking behavior.

Table 4. The results of logistic regression analysis for determining the predictors of the time of arriving at hospital in the first 120 minute after the onset of myocardial infarction (MI) manifestations

		OR	P	95% CI	
				Lower	Upper
The crude effect of SMS	SMS reception*	5.860	0.001	2.043	16.812

* SMS receiver group was reference.
SMS: Short Message Service; OR: Odds ratio; CI: Confidence interval

Conclusion

The findings of this study showed that sending SMS is a suitable method for public education. Therefore, it is suggested that periodic health messages, specially to reduce health problems, should be sent to the general population to improve the health-seeking and treatment-seeking behaviors of people, including using the EMS system.

In this study we had sent only two SMS. Future studies are recommended to replicate this study with sending the message more frequently and to larger samples of people. Moreover, assessing the long-term effects of this intervention can be another area to study. Furthermore, due to the positive impact of educational SMS on reduction of the onset-to-call and the onset-to-door times, the health care authorities are recommended to send regular educational SMS to the general population and reemphasize the crucial importance of rapid calling the EMS system in case of observing any cardiac symptoms. Consequently, the mortality and morbidity from cardiovascular disease might decrease and the effect of such intervention can be studied. However, field trials by using SMS are newly emerging and further studies are still needed to ensure their effectiveness in behavioral modification.

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Conflict of Interests

Authors have no conflict of interests.

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