INTERVENTIONS TO REDUCE PREHOSPITAL DELAY IN PATIENTS WITH ACUTE CORONARY SYNDROME: EVIDENCE-BASED NURSING

SHAIBAL KISHOR PAUL

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Shaibal Kishor Paul
.....
Mr. Shaibal Kishor Paul
Candidate

.....
Assist. Prof. Sarunya Koositamongkol, Ph.D. (Nursing)
Major advisor

.....Aurawamon S.....
Assoc. Prof. Aurawamon Sriyuktasuth, D.S.N.
Co- advisor

.....
Prof. Patcharee Lertrit, M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

Doungrut Wattanakit
.....
Assoc. Prof. Doungrut Wattanakitkrileart, D.N.S.
Program Director
Master of Nursing Science
Faculty of Nursing, Mahidol University

Thematic Paper
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on
July 7, 2016

Shaibal Kishor Paul
.....
Mr. Shaibal Kishor Paul
Candidate

Aurawamon S-!
.....
Assoc. Prof. Aurawamon Sriyuktasuth,
D.S.N.
Member

Usavadee Asdornwised
.....
Assoc. Prof. Usavadee Asdornwised,
Ph.D. (Adult Nursing)
Chair

Noraluk Ua-Kit
.....
Assist. Prof. Noraluk Ua-Kit,
Ph.D. (Nursing)
Member

Sarunya
.....
Assist. Prof. Sarunya Koositamongkol,
Ph.D. (Nursing)
Member

.....
Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

Yajai Sitthimongkol
.....
Assoc. Prof. Yajai Sitthimongkol,
Ph.D. (Nursing)
Dean
Faculty of Nursing
Mahidol University

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Shaibal Kishor Paul

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SHAIBAL KISHOR PAUL 5738459 NSAN/M

M.N.S. (ADULT NURSING)

THEMATIC PAPER ADVISORY COMMITTEE: SARUNYA KOOSITAMONGKOL, Ph.D., AURAWAMON SRIYUKTASUTH, D.S.N.

ABSTRACT

Acute Coronary Syndrome (ACS) is the leading cause of morbidity and mortality for people in Bangladesh and many other countries in the world. The morbidity and mortality of ACS depends on the time elapse from symptom onset to hospital arrival or prehospital delay. Therefore, reducing prehospital delay is crucial.

The purpose of this study was to summarize current relevant evidence on interventions to reduce prehospital delay in patients with ACS and draw conclusions on recommendations based on the evidence obtained. The study applied the search strategy, PICO framework, with appropriate use of keywords to search for relevant evidence from electronic database sources in the Mahidol University library system. One systematic review of experimental studies (Level-I), three randomized controlled trials (Level-II) and one quasi-experimental study (Level-III) were yielded by the search and included in the study. The evidence was evaluated by using the method and criteria as purposed by Melnyk and Fineout-Overholt (2015).

After synthesizing this evidence, individualized and public educational campaign interventions were found to be effective in improving prehospital delay in patients with ACS. Individualized educational interventions should be hospital-based for high-risk individuals during hospital admission and use motivational techniques. Public educational campaign intervention targeted the general public with the aim of improving knowledge and awareness of ACS symptoms to accelerate public contact with the ED for ambulance/EMS. Interventions should be covered by multimedia campaigns including television broadcasts, distributed leaflets, and group CPR training for layman, etc.

The findings suggest that clinical practice guidelines for reducing prehospital delays in patients with ACS should be developed and implemented based on contexts of Bangladesh. Further experimental research to evaluate the effectiveness of both interventions to reduce prehospital delay in patients with ACS is also suggested.

KEY WORDS: ACUTE CORONARY SYNDROME / INTERVENTIONS / PREHOSPITAL DELAY / EVIDENCE-BASED NURSING

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CHAPTER I
INTRODUCTION

1.1 Background and significance of the clinical problem

Acute Coronary Syndrome (ACS) is an important public health issue and one of the foremost causes of death in the world (Khraim & Carey, 2009; McKinley et al., 2009). ACS is also an umbrella term for the clinical signs and symptoms of myocardial ischemia (Overbaugh, 2009): classified as ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI) or unstable angina (UA) (O'Brien, McKee, Mooney, O'Donnell, & Moser, 2014) which is in the feasible group of further acute myocardial infarction (AMI). These classified diseases lead to high incidence, morbidity and mortality rates worldwide.

According to the American Heart Association (AHA)/American College of Cardiology (ACC) non-ST-elevation (NSTE)-ACS guideline (2014), ACS is the preliminary appearance of Coronary Artery Disease (CAD) presenting as an acute condition. In the United States in 2013, more than 900,000 persons had ACS in which nearly 70% of the patients (620,000) experienced first-time events and one person has ACS every 44 seconds (Clark, Beavers, & Osborne, 2015). Furthermore, 1 of every 5 persons (both men and women) dies from ACS as the initiating symptom of CAD (Khraim & Carey, 2009). According to the World Health Organization (WHO) in 2012, approximately 7.4 million people or 13.2 % of the global population died from ACS. Over the past decade (2000-2012), the mortality rates for CAD have increased from 6 million to 7.4 million, respectively (WHO, 2014). According to a statistical report from the British Heart Foundation, CAD is a major single cause of death in the United Kingdom. In 2012, approximately 74,000 patients died from this problem. Among the aforementioned group, 16% were males and 10% were females (British Heart Foundation, 2014). And, by 2020, ACS will be the only main cause of disease burden in several countries around the world (Lu & Nordin, 2013).

Reported at 0.12% to 0.31% in 2007, the incidence rate of ACS is very high in Europe (Widimsky et al., 2010). Furthermore, ACS can occur in both men and women. In 2010, the incidence rates of ACS patients in Sweden were 0.57% for men and 0.38% for women (Ravn-Fisher, Karlsson, Johanson, & Herlitz, 2013). For 30 years in Japan (1976- 2008), the ACS incidence rate increased from 7.4% to 27.0%, respectively (Takii et al., 2010). Similarly, the incidence of ACS in India is approximately 8-10% in urban areas and 3-4% in rural areas (Alexander, Mehta, Mullasari, & Nallamothu, 2012). According to these data, the ACS incidence rate has been increasing and the disease has become the most significant cause of morbidity and mortality worldwide.

In the Asia-Pacific region, the ACS mortality rate is increasing dramatically. The Asia-Pacific region comprises 50 countries and includes the most densely populated countries worldwide. The region is populated by more than 4.2 billion people, which is 60% of the global population. On average 7,000,000 die from CAD and ACS every year. ACS is now a leading cause of mortality in this region, accounting for approximately half of the global disease burden (Chan et al., 2015). Over the past 7 years in Korea (2001-2007), the ACS mortality rate has increased from 16.9% to 21.6% (Hwang, Zerwic, & Jeong, 2011). CAD is also one of the major causes of death in Australia. In 2007 and 2008, the total number of patients admitted for ACS was 161,417. Among these 34.7% were AMI patients and 24.0% were UA patients. Among the patients admitted in 2007 a total of 22,729 patients died (Australian Institute of Health and Welfare, 2011).

In South Asia, the morbidity and mortality rates for ACS are increasing gradually. Sri Lanka is a developing country in South Asia with population of approximately 21 million and a rapidly increasing burden of noncommunicable diseases. ACS is the leading cause of mortality in Sri Lanka. In 2012, a total of 5,619 patients died due to this problem. Over the past 8 years in Sri Lanka (2004-2012), the CAD mortality rate has increased from 11.6% to 14.4% (Annual Health Bulletin, 2012). In Nepal, the morbidity and mortality rates for ACS are very high. According to the data of the Shahid Gangalal National Heart Centre from 2001 to 2012, a total of 7,424 ACS patients were admitted. Among these 4,599 (61.9%) patients had STEMI, 1,913 (25.8%) had UA and 912 (12.3%) had NSTEMI. The mortality rates for

admitted patients were also very high (Adhikari et al., 2014). Thus, the importance of reducing ACS morbidity and mortality is essential.

The morbidity and mortality rates for ACS depend on the time from symptom onset to the time of treatment. If the time is shorter between symptom onset and treatment, the resulting cardiac function will be higher. Therefore, quick treatment with reperfusion, such as glycoprotein IIb/IIIa inhibitors, beta blockers, oral aspirin, clopidogrel, angiotensin-converting enzyme inhibitors and diuretics can reduce mortality and morbidity rates (McKinley et al., 2011). Time to treatment can be shortened if the patients reach the hospital early. Clearly, reducing prehospital delay is essential.

Prehospital delay is defined as the time from symptom onset until hospital arrival (Ottesen, Dixen, Torp-Pedersen, & Kober, 2004; Xie, Huang, & Hu, 2015). This period consists of the following two phases: 1) patient delay or decision delay time and 2) transportation delay time (Kainth et al., 2004; Kharim & Carey, 2009; Xie et al., 2015). Patient delay or decision delay time is the time since symptom onset to the basic decision to seek professional healthcare. Transportation delay time is the time from making the basic decision to seek professional healthcare to the time the hospital is reached (Kharim & Carey, 2009). Patient delay or decision delay times combined with transportation delay time is referred to as prehospital delay time (Kainth et al., 2004).

According to the European Society of Cardiology (ESC) guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation (2012), the time from symptom onset to hospital arrival (symptom to door time) and the time to treatment (door to balloon time) are together 120 minutes. During time of hospital arrival to time to treatment is identified as 30-90 minutes which is for fibrinolysis within 30 minutes or for primary percutaneous coronary intervention (PCI) within 90 minutes (ESC, 2012). And, as the result, the time from symptom onset to hospital arrival is left only 30-90 minutes. It means that prehospital delay should not exceed 30-90 minutes. Nowadays, prehospital delays in patients with ACS remains a problem and affects patients' prognosis (Riegel et al., 2011).

Patients' chance for survival is significantly improved if treatment is begun within 1 hour (golden hour) after symptom onset (Boersma, Mass, Deckers, &

Simoons, 1996; Gartner, Walz, Bauernschmitt, & Ladwig, 2008). A small number of patients actually arrive at the hospital within the golden hour (Gartner et al., 2008). Only 22% to 44% of patients with ACS reach the hospital within 2 hours after symptom onset, while 40% of patients have a prehospital delay time of longer than 4 hours. Approximately 25% to 33% of these patients still arrive at the hospital within 6 hours and 10% to 20% of the patients reach the hospital more than 12 hours after symptom onset (Gartner et al., 2008; Goldberg, Yarzebski, Lessard, & Gore, 2000). Therefore, prehospital time is an important event and needs to be shortened.

Considerable evidence has shown wide range of prehospital times to be a universal phenomenon (Gartner et al., 2008). In the United States, median delay ranges from 1.5 to 6.0 hours from symptom onset to hospital arrival (Moser et al., 2006). Furthermore, the global registry of acute coronary events (GRACE) shows the median delay to range from 2.2 to 4.0 hours in Australia/New Zealand, Argentina and Brazil (Goldberg et al., 2009). The mean prehospital delay time in Germany is now 3.12 hours (Gartner et al., 2008). Moreover, the median delays in the United and Australia are 2.5 to 6.4 hours, respectively. In addition, the median delay times are 2.5, 4.4, 4.5 and 6.4 hours in the United Kingdom, South Korea, Japan and Australia, respectively (Dracup et al., 2003; Gartner et al., 2008; McKinley et al., 2004). Accordingly, the median prehospital delay time ranges from 2.3 to 6.0 hours worldwide (Dracup et al., 2009). Therefore, prehospital delay time is a major issue that is responsible for high mortality across the world.

Based on the evidence, one third of deaths caused by ACS globally occur soon after symptom onset and before hospital arrival (Farshidi, Rahimi, Abdi, Salehi, & Madani, 2013). And in the United States approximately 1.2 million people die from ACS every year. Half of these patients die in an emergency department (ED) or before hospital arrival (Moser et al., 2006). It is estimated that 20–25% of ACS patients die either before they reached a hospital or ED (Mackay et al., 2014). Accordingly, the time taken to reach a hospital is a significant global health issue. Therefore, prehospital delay is also an essential issue for Bangladesh.

Prehospital delay is critical issue for Bangladesh. Nevertheless, no studies about prehospital delay in ACS have been conducted in a Bangladesh setting. However, the study of Kanthan et al. (2011) indicated that ACS patients in South

Asian countries including Bangladesh had this time was between 180-224 minutes longer than recommended of ESC (2012). It indirectly reflected that the ACS patients may not know about the sign and symptoms of ACS or how to manage when the symptoms occurred. Moreover, the study demonstrated that the prehospital delay time resulted in greater mortalities (Kanthan et al., 2011). Furthermore, there are some data on morbidity and mortality rates for ACS in a Bangladesh setting. The morbidity and mortality rate for ACS depends on early hospital arrival. In Bangladesh, hospital admission and mortality rates are increasing daily because there are not sufficient facilities for prehospital management. The National Institute of Cardiovascular Disease (NICVD) is the best cardiovascular centre in Bangladesh. According to data from the NICVD in 2014-2015, the ACS admission rate increased from 13,121 (30.27%) to 14,958 (30.35%) and the mortality rate increased from 1,161 (37.24%) to 1,540 (42.13%) (Health Bulletin, 2014 & 2015). Chittagong Medical College Hospital (CMCH) is one of the second largest referral hospitals in Bangladesh. According to data from the CMCH in 2014, the ACS admission rate was 8,000 (5.87%) and the mortality rate was 169 (2.25%) (Health Bulletin, 2014).

Data from many countries clearly indicates that ACS is a major problem, while prehospital delay in patients with ACS is a major issue for developed and developing countries, including Bangladesh.

Impacts of prehospital delay in patients with ACS

Delays of several hours have a significant impact on patient survival whereby a 30 minute delay decreases the average life expectancy with a year (Dracup et al., 2009). A large amount of the morbidities, mortalities and potentially preventable complications are related to prehospital delays in patients with ACS. Timely intervention is critical to the prevention of mortality and morbidity from ACS ischemia. After the onset of ischemia, myocardial cell death turns to necrosis within 2-4 hours. The return of blood flow to an invaded artery within 30 minutes has the potential to reverse these events (Mooney et al., 2012). Delay in reaching hospital affects patients' health. A number of complications subsequently arise such as ventricular arrhythmias, particularly lethal ventricular arrhythmias, with sustained ventricular tachycardia and ventricular fibrillation, which are common in the early

phase of STEMI. Patients with STEMI cardiac arrest frequently have lethal ventricular arrhythmias (Peng et al., 2014) which are reported as the cause for approximately 50% of deaths due the first hours of ACS (Mooney et al., 2012).

Prehospital delay in ACS not only has impact on patients but also affects on family members and hospitals. Prehospital delay increases the burdens of family caregivers taking care of these patients and poses a serious economic threat. The most significant effects are caused by hospital burdens such as increased duration of hospital stay, bed occupancy, increased workload, increased hospital mortality rates and higher re-admission rates. The impact of prehospital delay in ACS can be reduced by prehospital management, prompt diagnosis and treatment.

Prehospital management of ACS

Without delay, diagnosis and treatment offer optimum benefits for myocardial rescue during the first hours of STEMI. Promptly alerting management of UA and NSTEMI decreases unfavorable events and improves results/outcomes. According to AHA guidelines for cardiopulmonary resuscitation and emergency cardiovascular care science (2010), prehospital management of ACS includes initial EMS care, prehospital electrocardiography's (ECGs), prehospital fibrinolysis and, prehospital triage and transfer.

1) Initial EMS care: ED employees can give information to the patient or caller before EMS arrival. EMS providers should advise patients to chew an aspirin (as long as there is no aspirin allergy) prior to the arrival of EMS (American Heart Association, 2010), because aspirin is an antiplatelet drug and antiplatelet treatment is more effective in the acute phase of ACS (Clark, Beavers, & Osborne, 2015). Moreover, the instant antiplatelet and anti-inflammatory effects of aspirin can help promptly handle the occlusive thrombus and return flow to the infarcted myocardium (Freimark et al., 2002).

Furthermore, EMS providers should check vital signs, cardiac rhythm and arrange to give cardiopulmonary resuscitation (CPR) with defibrillation, if necessary. EMS providers should provide oxygen (O_2) throughout the early assessment of patients suspected to have ACS (American Heart Association, 2010). O_2 has been used in the treatment of ACS for over 100 years. The basis for its

longstanding use is that it increases O_2 delivery to the ischemic myocardium, thereby minimizing the effects of ACS and improving clinical outcomes (Wijesinghe et al., 2009). If the patient is dyspneic, hypoxemic or exhibits clear signs of heart failure, EMS providers should initiate titrate therapy based on monitoring of oxyhemoglobin saturation > 94% (American Heart Association, 2010). EMS providers should give up to three nitroglycerin doses (tablets or spray) at intervals of 3 to 5 minutes and check blood pressure or pain level every 5 to 10 minutes after administering nitroglycerin (Overbaugh, 2009). Morphine is indicated in STEMI whereas chest pain is impassive to nitrates (American Heart Association, 2010; Overbaugh, 2009).

2) Prehospital ECGs: Prehospital 12-lead ECG confirms diagnosis sooner and accelerates treatment for patients with ACS (Feldman, Brinsfield, Bernard, White, & Maciejko, 2005). EMS providers should generally perform a 12-lead ECG as soon as possible if patients show signs and symptoms of ACS. The ECG may be sent for remote diagnosis by an ED doctor, trained nurse or paramedics for confirmation of STEMI with or without the help of computer interpretation (American Heart Association, 2010). Moreover, performance of an ECG by cellular modem to the ED has been revealed to decrease prehospital delay for treatment of ACS and give exact reports for field thrombolysis judgments to ED doctors (Feldman et al., 2005).

3) Prehospital fibrinolysis: Evidence has shown the benefits of initiating fibrinolysis (e.g. tissue plasminogen activator such as streptokinase or urokinase) as soon as possible after the onset of ischemic-type chest pain/discomfort in patients with confirmed STEMI (American Heart Association, 2010). ACS generally occurs between the first 30-90 minutes after coronary artery occlusion. Therefore, if coronary blood flow can be restored during this period, myocardial necrosis can be incomplete and heart function conserved with better survival rates. The decrease of death presented by thrombolysis is considerably greater when patients are treated within two hours of symptom onset. Thrombolysis completed with the first hour reduces the mortality rate by 50% and saves approximately 50 to 60 lives per 1000 patients treated. The advantage is similar to that gained by primary angioplasty in contrast with in-hospital thrombolysis, but at a lower price. The perfect reperfusion strategy may consist of precocious thrombolysis pursued by moving to a cardiology or

tertiary hospital for angioplasty in patients where thrombolysis was unsuccessful (Dussoix, Reuille, Verin, Gaspoz, & Unger, 2003).

4) Prehospital triage and transfer: Direct triage from the sight to a PCI by a competent hospital may decrease prehospital delay for optimal treatment and improve outcomes (American Heart Association, 2010). Based on the evidence, when transfer time is less than 30 minutes, the mortality rate is significantly reduced from 8.9% to 1.9% (May et al., 2006). If PCI is essential for prehospital STEMI patients, it is realistic to transfer patients directly to a nearby PCI facility hospital rather than nearby EDs as necessary (American Heart Association, 2010).

Clearly, prehospital management remains ineffective because many factors are related to prehospital delay in patients with ACS.

Factors related to prehospital delay in patients with ACS

Different factors including socio-demographic, contextual, cognitive and affective, behavioral and clinical factors are associated with prehospital delay in ACS as follows.

1) Socio-demographic factors: Socio-demographic factors such as gender, age, marital status, health insurance, ethnicity, socio-economic characteristics and educational status are correlated with prehospital delay (Khraim & Carey, 2009; Xie et al., 2015). Female patients with ACS have a prolonged decision-making process compared with male patients. Moreover, older patients have more comorbidities than younger patients, which may result in longer prehospital delays (Dracup et al., 2006; McKee et al., 2013; Xie et al., 2015). Marital status is one of the factors correlated with prehospital delay. Moreover, single people are prone to greater delays than married people (Khraim & Carey, 2009; McKee et al., 2013; Perkins-Porras, Whitehead, Strike, & Steotoe, 2009; Xie et al., 2015), while people who have medical insurance are prone to longer delays than the non-insured (Khraim & Carey, 2009; McKee et al., 2013; Xie et al., 2015). In comparison to Negro or other ethnicities, Caucasians tend to have significantly shorter delays. On the other hand, specific cultural health beliefs and perceptions are correlated with longer delays (Khraim & Carey, 2009; Xie et al., 2015). In addition, patient's poor economic status

and low-education levels are associated with longer prehospital delay (McKee et al., 2013; Park et al., 2012; Xie et al., 2015).

2) Contextual factors: Patients with ACS symptom onset at night (Park et al., 2012; Xie et al., 2015) and on weekdays (Khraim & Carey, 2009) is correlated with prehospital delay. When ACS symptoms begin at home (Khraim & Carey, 2009) or in a public place, the result can be a delay to timely treatment (Xie et al., 2015).

3) Cognitive and affective factors: Patients may feel their symptoms manifest as a heartburn or indigestion. This mismatch symptom is associated with delay. Feeling confused to call the ambulance is correlated with increased prehospital delay (Khraim & Carey, 2009). Denial is a common response among patients with signs of ACS and a common cause of prehospital delay (Xie et al., 2015).

4) Behavioral factors: Calling or visiting a primary care provider (PCP), self-treatment and transportation factors are correlated with prehospital delay. Calling the EMS instantly rather than the PCP is correlated with significantly shorter delays (Khraim & Carey, 2009; Xie et al., 2015). Self-treatment with drugs or rest also leads to delay. The transportation factor is mainly separated into calling for ambulance and self-transport. Patients choosing an ambulance rather than any other mode of transportation/self-transport reduce prehospital delay (Xie et al., 2015).

5) Clinical factors: Some different symptoms such as weakness, shortness of breath, anxiety, abdominal discomfort or perspiration can occur when experiencing ACS. These symptoms are associated with a significantly longer prehospital delay (Xie et al., 2015). Furthermore, patients with a history of smoking, diabetes, hypertension, angina pectoris (McKee et al., 2013; Xie et al., 2015) ACS and heart failure have been found to be delayed longer than those without these conditions (McKee et al., 2013). Previous history of cardiac interventions e.g. percutanerous transluminal coronary angioplasty/stent or coronary artery bypass graft (CABG) can also reduce prehospital delay (Khraim & Carey, 2009; McKee et al., 2013; Xie et al., 2015).

Although predicting factors can lead to prehospital delay in ACS, effective interventions to intervene manageable factors may lead to reduction of prehospital delay.

Interventions to improve prehospital delay in patients with ACS

According to evidence, several interventions have been used to reduce prehospital delay in patients with ACS as follows:

1) Community intervention: One of the major community interventions employed was the Rapid Early Action for Coronary Treatment (REACT) trial, conducted in 1995 to 1997 in which theoretically-based and multi element programs were targeted at community groups such as community, public, professional and patient organizations. The intervention conducted in 20 United States communities aimed to decrease patient delay from symptom onset to hospital arrival and increased EMS use (Luepker et al., 2000; Mooney et al., 2012).

2) Nationwide public campaign intervention: Nationwide public campaign interventions have been used to reduce prehospital delay in patients with ACS in several countries.

In the United States, a public media campaign was carried out in 1986, with the aim of reducing patient delay and increasing EMS use. The campaign was covered by newspaper, television and radio advertisements, and conveyed the message, “Saving time could save your life,” which emphasized symptom recognition and correct responses to symptoms (Ho, Eisenberg, Litwin, Schaeffer, & Damon, 1989; Mooney et al., 2012). Moreover, another mass media intervention was conducted in the United States. The intervention was covered by public education brochures, public discussions, posters and radio, television and newspaper advertisements (Mooney et al., 2012; Moses et al., 1991). In 1991, a direct mail campaign was conducted in the same country aimed at increasing EMS use via 911 calls and reducing prehospital delay. The campaign conveyed the message, “Call Fast, Call 911,” (Meischke et al., 1997; Mooney et al., 2012).

In Switzerland, a multimedia public campaign was launched in 1992 with the slogan, "Heart attack? Every minute counts! Call 144!” aimed at reducing prehospital delay with chest pain. The campaign was covered by radio and

television broadcasts, press conferences, newspaper reports and advertisements, posters, leaflets and e-mail (Gaspoz et al., 1996). Furthermore, another nationwide public campaign was conducted by the Swiss Heart foundation from 2005 to 2008 by using nationwide acute myocardial infarction in Switzerland (AMIS) plus patient registry. The intervention was covered by a multimedia campaign including television broadcasts, distributed leaflets and group training for layman resuscitation, etc. (Naegeli et al., 2011).

In Australia, the National Heart Foundation (NHF) of Australia launched a National Heart Week campaign in 1989 aimed at encouraging possible symptoms of ACS and seeking help as soon as possible (Bett, Aroney, & Thompson, 1993). From 2009 to 2013, the NHF launched the warning signs of heart attack strategy. This multifaceted strategy was aimed at generating greater relevance in the community regarding the danger of heart attacks, promoting knowledge about warning signs and symptoms of heart attack, making early decisions and actions based on decision-making and building awareness among people to call an ambulance as soon as possible. The campaign was conducted by advertising on television, radio and websites, stories in newspapers and distributed leaflets in community groups and hospitals (Bray et al., 2015).

In Sweden, a media campaign was conducted in 1987 with the aim of reducing prehospital delay times and increasing the ambulance use for ACS patients. The campaign was covered by newspaper advertisements and leaflet distribution, and conveyed the slogan, “Heart-Pain-9000,” (Blohm, Hartford, Karlson, Karlsson, & Herlitz, 1994; Mooney et al., 2012). Based on the aforementioned evidence, public campaign interventions have been significantly conducted worldwide.

3) Educational intervention: According to the literature review, one educational intervention was conducted in Dublin, Ireland, from 2007 to 2009 with the aim of decreasing prehospital delays in ACS and improving proper responses to symptoms. The intervention was a hospital-based 40-minute individualized education session that was reinforced after 1 and 6 months by phone and posted letters, respectively (Mooney et al., 2014).

Other educational and counseling interventions were conducted in the United States, Australia and New Zealand from 2002 to 2004. The

intervention was compose of community/clinic-based 40-minute individualized face-to-face education sessions and reinforced after 1 and every 6 months by phone (Dracup et al., 2009).

Although different interventions have been conducted in many developed countries across the world, no interventions have been conducted in developing countries such as Bangladesh. Therefore, effective interventions should be identified. Furthermore, effective interventions should be applicable to reduce prehospital delay in patients with ACS in the clinical setting of Bangladesh.

1.2 Clinical problem of the study

Prehospital delay in patients with ACS is one of the most important health problems and the main cause of mortality and morbidity in Bangladesh. Therefore, urgent action is required to solve the issue. Bangladesh is a developing country where most people live in rural areas. The economic conditions of the people are not good. Therefore, people are afraid to go hospital due to these poor economic conditions. Bangladeshi people are not conscious about their health and most of have very low levels of knowledge about ACS symptoms. Due to insufficient knowledge, patients perceive that symptoms of chest pain are heartburn or indigestion and neglect to seek immediate treatment. In Bangladesh, another problem is the shortage of cardiac treatment facilities. Although cardiac treatment facilities are good in urban areas, they are not readily available in rural areas. Rural people are dependent on informal healthcare providers due to the shortage of professional doctors and nurses. Moreover, transportation facilities are not good. Therefore, patients cannot reach hospital in time and most patients die before reaching a hospital. Bangladesh is an over-populated country. Based on the author's perspective from a Bangladeshi context and the author's work experience, ambulance services are not available in the country. In particular, ambulance services are not sufficient at the community level. Furthermore, EMS is not available. There are no trained EMS nurses or providers in Bangladesh.

In Bangladesh, most nurses do not provide health education for their patients during hospital admission or discharge periods concerning modifiable lifestyles, health indices, diet and severity of ACS. Nurses may have no sufficient

knowledge about prehospital management of ACS. They do not utilize evidence-based nursing practice and no any guidelines available to reduce prehospital delay. As previously stated, Bangladesh has not performed any interventions to reduce prehospital delay in relation to ACS. Therefore, patients are taking longer to reach a hospital and this delay becomes the cause of different complications. Intervention programs to improve patient, family and public knowledge and awareness can be very helpful in reducing prehospital delay and subsequent complications. In this situation, the author recognizes the need for effective interventions from research evidence to reduce prehospital delay in patients with ACS. As a result, evidence-based interventions will help reduce prehospital delay in patients with ACS in Bangladesh.

1.3 Purpose of the study

To summarize all related evidence in regard to effective interventions to reduce prehospital delay in patients with ACS and draw conclusions on recommendations based on the evidence obtained.

1.4 Expected benefits of the study

1.4.1 After completion of the study, the contents synthesized from the evidence can be utilized as recommendations on interventions to reduce prehospital delay in patients with ACS in Bangladesh.

1.4.2 Guidelines on interventions to reduce prehospital delay in patients with ACS can be further developed and implemented in Bangladesh.

CHAPTER II
METHODOLOGY

This study aimed to find evidence to answer the clinical therapy question, "What effective interventions are available to reduce prehospital delay in patients with ACS?" In this chapter, the searching strategy, appraisal methods and level of evidence are described as follows:

2.1 Search Strategy

A search strategy was applied to find evidence for analysis and synthesis of the evidence related to interventions to reduce prehospital delay in patients with ACS. The strategy for searching evidence employed the PICO format with appropriate use of keywords.

2.1.1 Search framework: The PICO framework (Melnyk & Fineout-Overholt, 2015) was used to search and select evidence for the interventions to reduce prehospital delay in patients with ACS. The details of the PICO framework are as follows:

P (Population) = Patients with Acute Coronary Syndrome
I (Intervention) = Interventions
C (Comparison) = None
O (Outcome) = Prehospital delay

2.1.2 Scope of the search: Interventions to reduce prehospital delay in patients with ACS based on validated evidence were searched based on the following scope:

1) Keywords used in the search according to the PICO framework:

P (Population)	=	Acute Coronary Syndrome
		Acute Myocardial Infarction
		Coronary Artery Disease
		Heart attack
I (Intervention)	=	Intervention
		Nursing intervention
		Strategy
		Educational program
		Health education
C (Comparison)	=	None
O (Outcome)	=	Prehospital delay
		Prehospital delay time
		Hospital arrival
		Delay time to hospital access
		Time to door
		Time to hospital
		Time to treatment

The search used a Boolean operator. For each PICO element, the author collected any synonyms by linking terms with “OR”, then located citations relevant to all the PICO elements by linking with “AND”.

2) Databases/sources used for the search: The author searched for evidence from several electronic databases/sources of the Mahidol University library system. The selected databases used in the search for evidence included the following:

- Cochrane Database of Systematic Reviews
- Joanna Brigges Institute Systematic Reviews Database
- Blackwell Synergy
- Cumulative Index to Nursing and Allied Health (CINAHL)
- High Wire
- Ovid Full Text
- Pro-Quest nursing and Allied Health Source

- PubMed
- Science Direct
- Springer Link

Furthermore, manual searching was used to search for single research studies. The author traced back the references from the journal retrieved and then searched further from libraries and electronic databases.

3) Types of evidence: The author searched for systematic reviews of experimental studies, high quality single randomized controlled trials and quasi- experimental studies acquired from full text studies published in English from 2000 to 2015.

2.2 Appraisal method and levels of evidence

2.2.1 Evidence appraisal method

The author used the method and criteria as purposed by Melnyk and Fineout-Overholt (2015). The critical appraisal process was performed by answering the following questions.

1) Are the results of the study valid?

For experimental studies, the validity of empirical evidence refers to whether the evidence was conducted through scientific procedure and able to scientifically answer the questions raised. Randomization is essential to experimental studies because different outcomes are expected from two groups involved in intervention and comparison groups. The strongest research design helps to meet the standards where two or more groups are formed and the author control changes in the cause/therapy for each group. To decrease the influencing factors, randomization is a significant section for validating the study and helps create feasible outcomes based on the evidence-based study. Selection bias is reduced by random assignment. The author should take steps toward randomly assigning the process in order to ensure that confounding variables that would easily compromise the findings and bias are removed. In addition, most of the evidence should consist of sufficient sample groups, appropriate control groups and populations with care-givers and research personnel

kept blind to treatment. To evaluate the validity of the study, the author should critically follow the measurement procedures in order to determine whether or not the instrumentation is appropriate for measuring the outcome. If the measurement instrumentation is unable to provide accurate results, a measurement bias will be determined. During the appraisal of the evidence, the author considered the different factors at risk for distorting the findings and ensured the validity of the evidence.

For systematic reviews, the clinical questions, databases (e.g. Cochrane library, CINAHL, EMBASE, MEDLINE), years, strategies and search terms should be clearly identified. Systematic and comprehensive searches should be conducted in line with the objectives with suitable methodology. The selection criteria should be appropriate, and the inclusion and exclusion criteria should be stated in the systematic review. Data extraction and quality assessment should be done by using standard procedures to reduce bias. Systematic reviews should clearly report how the aforementioned was conducted and what criteria were used for evaluation in order for the review results to be considered as valid.

2) What are the results?

For experimental studies, this appraising question is concerned with the treatment effects in terms of sufficient clinical and statistical influence on practice. The effectiveness of interventions are justified by considering both the clinical significance of the results and the statistical significance of the findings.The confidence interval (CI) provides information about the statistical significance of the results. If the value corresponding to no effect falls outside the 95% CI then the results are statistically significant at the p value of .05. This study considered the p value and CI when the research revealed data based on the analysis.

For systematic reviews, the systematic review provides a clear summary of the data from the results of a number of individual studies. The effectiveness of the interventions largely depends on ability to target selective problems of the study. The interpretations of the reviewers are justified and applicable based on the strength of the evidence presented in the review.

3) Will the results help in caring for patients?

For experimental studies, the application of the evidence requires consideration about the population and whether or not the participants are

similar to the author's own evidence population. Interventions should be applied in practical settings with consideration of effectiveness. The cost-effectiveness and potential harm of interventions are analyzed during the appraisal to ensure that the intervention is applicable to the target population.

For systematic reviews, the questions of the systematic review consider population similarity, feasibility, outcomes, preferences and values. The study population is similar to the population in the author's setting. The findings of the review were also feasible for the author's clinical setting. The important outcomes, including risks and benefits of the interventions, were considered. The population or family preferences and values with the interventions under consideration were similar with the studied population.

2.2.2 Levels of evidence

The strength of the evidence was appraised by applying the criteria suggested by Melnyk and Fineout-Overholt (2015) named the "Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions" as in the following table:

Table 2.1 Levels of evidence (Melnyk & Fineout-Overholt, 2015).

Level of evidence	Source of empirical evidence
Level I	Evidence from systematic reviews
Level II	Evidence from randomized controlled trials
Level III	Evidence from controlled cohort studies
Level IV	Evidence from uncontrolled cohort studies
Level V	Evidence from case studies and case series, qualitative and descriptive studies, evidence-based practice (EBP) implementation and QI projects
Level VI	Evidence from expert opinion

CHAPTER III
FINDINGS

The result of the search and summary of the evidence are described concerning the interventions for reducing prehospital delay in patients with ACS. The details are as follows:

3.1 Search results

The author searched for available evidence from different sources by using Mahidol University databases. After completing the search, the author found various types of evidence, including experimental research and systematic reviews. According to the search framework and scope of the search, the author found 12 evidence. After the screening, 7 evidence were excluded because some of the evidence did not provide the details of the interventions and some of the outcomes did not qualify as the outcome of interest in the present study. Therefore, a total of 5 studies were included in this study comprising 1 systematic review of experimental studies (Level-I), 3 randomized controlled trials (Level-II) and 1 quasi-experimental study (Level-III) published in English from 2000 to 2015. The author then appraised the evidence based on the proposed appraisal methods. The list of the evidence found from the search with the type and level of evidence are shown in Table 3.1.

Table 3.1 List of evidence yielded by the search

No	Authors/ Title /Source of publication	Types of evidence	Level of evidence
1	Kainth, A., Hewitt, A., Pattenden, J., Sowden, A., Duffy, S., Watt, I., … Lewin, R. (2004). Systematic review of interventions to reduce delay in patients with suspected heart attack.	Systematic review of experimental studies	I

Table 3.1 List of evidence yielded by the search (Cont.)

No	Authors/ Title /Source of publication	Types of evidence	Level of evidence
	Emergency Medicine Journal, 21(4), 1-6.		
2	Mooney, M., McKee, G., Fealy, G., O'Brien, F., O'Donnell, S., & Moser, D. (2014). A randomized controlled trial to reduce prehospital delay time in patients with acute coronary syndrome (ACS). *The Journal of Emergency Medicine, 46*(4), 495-506.	Randomized controlled trial	II
3	Dracup, K., McKinley, S., Riegel, B., Moser, D. K., Meischke, H., Doering, L. V., … Pelter, M. (2009). A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome. *Circulation: Cardiovascular Quality Outcomes, 2*(6), 524-532.	Randomized controlled trial	II
4	Luepker, R.V., Raczynski, J.M., Osganian, S., Goldberg, R. J., Finnegan, J. R., Hedges, J. R., … Simons-Morton, D. G. (2000). Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. *The Journal of the American Medical Association, 284*(1), 60-67.	Randomized controlled trial	II
5	Naegeli, B., Radovanovic, D., Rickli, H., Erne, P., Seifert, B., Duvoisin, N., … Bertel, O. (2011). Impact of a nationwide public campaign on delays and outcome in Swiss patients with acute coronary syndrome. *European Journal of Cardiovascular Prevention & Rehabilitation, 18*(2), 297-304.	Quasi-experimental study	III

3.1.1 The author discovered five evidence and briefly summarized each evidence as follows:

Evidence No. 1

Title: Systematic review of interventions to reduce delay in patients with suspected heart attack.

Authors: Kainth et al. (2004).

Publication source: Emergency Medicine Journal, 21(4), 1-6.

Objectives: To assess the effectiveness of interventions aimed at decreasing the time from ACS symptom onset to seeking medical help/hospital arrival.

Methodology

Design: Systematic review of experimental studies.

Sample: The sample comprised 11 articles. Among these 2 were randomized controlled trials, 1 was a controlled trial and 8 were before and after studies.

Search methods: 15 databases were searched e.g. Cochrane library, CINAHL, EMBASE, ERIC, Medline, PsycINFO etc. The internet and bibliographies of included studies and contacted persons to identify any other relevant studies.

Study selection: The studies were published in all languages during 1963-2001. The study intervention/campaign was aimed at decreasing the time from signs and symptoms of ACS start to hospital arrival/medical help. Prehospital delay was the outcome. The review consisted of a randomized controlled trial, control trials, or before and after studies.

Data extraction and quality assessment: The studies were approved by one observer and checked by another observer. Discrepancies were determined by discussion and, if required, through an alternative third reviewer. Research strength was evaluated by a checklist modified from the Centre for Reviews and Dissemination's (CRD's) Guidance.

Data analysis: The evidence was synthesized in a narrative format with tables.

Results: Five out of 11 studies (one controlled trial and four before and after studies) showed that the interventions had statistically significant results on delay time. The results from each study are described as follows:

1) Median delay time decreased from 4 to 2.9 hours ($p = 0.007$) (Maeso et al., 2000).

2) Delay time decreased from 3 hours to 2 hours and 20 minutes ($p < 0.001$) (Blohm et al., 1994).

3) Median prehospital delay decreased from 180 minutes to 155 minutes (25 minutes) [$p < 0.001$] (Gaspoz et al., 1996).

4) An increase in the percentage of people delaying less than 1 hour from 15.5% to 23.2% ($p = 0.01$) and an increase in the percentage of people delaying less than 6 hours from 58.5% to 66.0% ($p = 0.05$) (Maeso et al., 2000).

5) An increase in the percentage of people delaying 2 hours or less from 15.8% to 31.3% ($p < 0.05$) (Mitic & Perkins, 1984).

In addition, some studies showed an increase in emergency switch board calls and ED visits.

In conclusion, the systematic review reported that five studies had statistically positive results on delay time, while another five studies (two randomized controlled trials and three before and after studies) had no statistically significant results on delay time and one before and after study did not conduct any statistical analysis.

Evidence No. 2

Title: A randomized controlled trial to reduce prehospital delay time in patients with acute coronary syndrome (ACS).

Authors: Mooney et al. (2014).

Publication source: The Journal of Emergency Medicine, 46(4), 495-506.

Objective: To investigate an educational intervention to decrease patient prehospital delay in ACS and improve response to symptoms**.**

Methodology

Design: Randomized controlled trial.

Sample: The sample comprised 1,944 patients with ACS. Samples were randomly assigned into equal two groups. Each group (control and intervention groups) was composed of 972 patients.

Inclusion criteria: Patients with ACS, clinically steady at time of enrollment, access to a telephone and ability to read, understand and communicate in English.

Exclusion criteria: Patients with hearing loss, neurological disease, learning default, serious complicating comorbidities or untreated malignancies and patients living in a hospital setting.

Setting: Five tertiary hospitals in Dublin, Ireland.

Outcome measurement: Time from symptom onset to time of hospital arrival, measured with the ACS Response Index.

Data analyzed: Chi-squared tests and analysis of variance (ANOVA).

Intervention: The educational intervention was based on Leventhal's Self-Regulatory Model of health and illness. Hospital-based 40-minute individualized education sessions, use of the motivational technique with reinforcement after 1 and 6 months by phone and letter, respectively. The intervention was conducted by the research nurse. Educational aids were used with preprinted flip charts and prescriptive content. The patients received continual hospital follow-up at 3, 12 and 24 months by phone. Education sessions were based on the following contents:

1) Benefits of timely response to symptoms.
2) Importance of informing someone at symptom onset.
3) Importance of use prescribed nitrates in time.
4) Performing role-play in developing of an action plan.
5) Importance of improving cognitive and emotional responses.
6) Importance of ambulance use rather than other modes of transportation.
7) Advantageous to entrance the nearest ED in the initial phase of ACS symptoms.

8) Importance of avoiding consultation with general practitioner (GP) in the initial phase of ACS symptoms.

9) At discharge, every patient was given a card and reminder of the key intervention messages.

Results: The educational intervention achieved a reduction in prehospital delay time and related behaviors in patients with ACS. The results included the following:

1) The median prehospital delay time was significantly lower at 1.70 hours in the intervention group and 7.10 hours in the control group ($p < 0.001$).

2) The intervention group had a lower rate of discussion with a GP prior to attending the ED ($p < 0.02$).

3) The intervention group had a higher rate of presenting symptoms to another individual within 30 minutes of onset ($p < 0.01$).

4) The intervention group had no significant difference in nitrate ($p = 0.06$) or ambulance use ($p = 0.51$).

Evidence No. 3

Title: A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome.

Authors: Dracup et al. (2009).

Publication source: Circulation: Cardiovascular Quality Outcomes, 2(6), 524-532.

Objective: To evaluate the decrease in time from ACS symptom onset to hospital arrival and to improve patients' knowledge, attitudes and beliefs regarding cardiac symptoms in addition to seeking care without delay.

Methodology

Design: Randomized controlled trial.

Sample: 3,522 patients with Coronary Heart Disease (CHD) were randomized to experimental and control groups of 1,777 and 1,745, respectively.

Inclusion criteria: Patients with confirmed diagnosis of ischemic heart disease and living independently.

Exclusion criteria: Patients with psychiatric disease, neurological illness and untreated malignancy with damaged cognition or no ability to read or understand English.

Setting: Outpatient clinic, doctor's office or patient's home.

Outcome measurement: Time from symptom onset to hospital arrival, measured by hospital or EMS prehospital medical records.

Data analyzed: Chi-squared tests, independent t-test and analysis of variance (ANOVA).

Intervention: The educational and counseling intervention was based on Leventhal's Self-Regulatory Model of illness and educated patients in the three areas including information about ACS, emotional issues and social factors. The intervention was recommended by National Heart Attack Alert Program. The intervention was clinic/community-based 40-minute individualized face-to-face education sessions and reinforcement at 1 and every 6 months later by phone. The intervention was conducted by a cardiology expert nurse. The educational aids, flip charts, were used for both patients and family members. Therefore, both patients and family members received similar information mechanisms. The patients received follow up after 3, 12 and 24 months by phone. The education sessions were based on the following contents:

1) Education about ACS symptoms and possible variability of symptom presentation.

2) Importance of calling EMS instantly.

3) Importance of taking aspirin or nitroglycerin (if prescribed) prior to arrival at hospital.

4) Discussion with the patients about their previous experiences with the medical system.

5) Performing role-play to highlight treatment seeking and emotional issues.

6) Encouraging spouses, family members or friends to make decisions about their role if the patient hesitates to call EMS.

7) At discharge, every patient was given an advisory form with key intervention messages.

Results: The education and counseling intervention did not decrease prehospital delay time or improve EMS use, although it significantly increased knowledge, attitudes and beliefs about ACS, responded to ACS symptoms and increased the patients' use of aspirin before hospital arrival. The results included the following:

1) The median prehospital delay time was not significantly lower at 2.20 hours in the experimental group and 2.25 hours in the control group ($p = 0.40$).

2) The experimental group did not have significantly increased EMS use ($p = 0.89$).

3) The experimental group had significantly increased incidence of calling the EMS ($p = 0.036$).

4) The experimental group significantly increased taking aspirin following symptom onset ($p = 0.02$).

Evidence No. 4

Title: Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial.

Authors: Luepker et al. (2000).

Publication source: The Journal of the American Medical Association, 284(1), 60-67.

Objective: To examine a community-based intervention for decreasing prehospital delay from symptom onset to hospital arrival and enhancing EMS utilizes.

Methodology

Design: Randomized controlled trial.

Sample: The sample comprised 20,364 patients with acute coronary heart disease. The patients were randomly assigned into an intervention and reference or control group at 10,563 and 9,801, respectively.

Inclusion criteria: Adults aged 30 years and up with suspected acute coronary heart disease or CHD-related diagnosis.

Exclusion criteria: Institutionalized persons and other reasons for chest pain without suspected ACS or CHD-related disease.

Setting: Twenty United State communities.

Outcome measurement: Time from symptom onset to hospital arrival, measured by hospital or EMS prehospital medical records.

Data analyzed: Linear regression of log and paired t-test.

Interventions: The community intervention was a theoretical-based (self-regulatory theory, social cognitive theory and diffusion theory social, marketing and community organization principles). The eighteen month program was developed to improve ACS treatment by decreasing delay to health care system arrival. The multi-element strategies used in this intervention were as follows:

1) Community organization in which medical or non-medical leaders and organizations in every community formed a local consultative group. The intervention processes were networking, partnership-building and training.

2) Community/public education targeted risk group for ACS, spouses and families and the public. Six themes of public education emerged such as building awareness and knowledge about ACS symptoms and proper actions, recognition of ACS symptoms, survival plan for ACS, ACS in women, observed reactions to ACS and importance of calling EMS. The intervention processes were mass media, small media, group programs and magnet events.

3) Professional education included doctors, nurses, ED staff, rehabilitation staff and ambulance staff. The intervention processes were continuing education meeting, hospital teams, academic detailing and targeted mailing.

4) Patient education focused on changing patients' knowledge, attitudes, beliefs, behaviors, skills and self-efficacy about quick action for ACS symptoms. The intervention processes were individual counseling, group education, video and print materials, conducted by REACT staff.

Results: The community intervention reduced delay time but with no significant difference comparison to the reference communities. However, the intervention did increase the use of EMS. The results were as follows:

1) Delay time was significantly reduced in the intervention group (- 4.7% per year, 95% confidence interval [CI], - 8.6% to - 0.6%) but did not differ significantly in the reference or control groups (- 6.8% per year, 95% CI, - 14.5% to 1.6%, p = .54).

2) EMS use significantly increased in the intervention group compared with the reference or control groups with a net effect of 20% (95% CI, 7%-34%; $p < .005$).

Evidence No. 5

Title: Impact of a nationwide public campaign on delays and outcome in Swiss patients with acute coronary syndrome.

Authors: Naegeli et al. (2011).

Publication source: European Journal of Cardiovascular Prevention & Rehabilitation, 18(2), 297-304.

Objective: To improve at shortening prehospital delay for ACS, including improved knowledge and awareness of ACS symptoms, acceleration of patient contact with EMS and dissemination of skills for resuscitation and basic life support to the people.

Methodology

Design**:** Quasi-experimental study.

Sample: The sample comprised 8,906 patients with ACS in which 5,006 patients were assigned to the pre-intervention session and 3,900 patients were assigned to the post-intervention session.

Outcome measurement: Time between symptoms start to hospital admission, measured from questionnaire and AMIS plus registry.

Data analyzed: Chi-square test and Mann-Whitney U-test.

Interventions: The intervention was conducted by the Swiss Heart Foundation in 2005 to 2008 and used nationwide in the AMIS plus patient registry. The nationwide public campaign was covered by television broadcasts, distributed leaflets, promotions, public dissemination, group CPR training for layman with certification and inclusion in school syllabuses.

Results: The nationwide public campaign significantly reduced prehospital delay in patients with ACS. Furthermore, this intervention reduced the re-infarction rate and increased the out-of-hospital/prehospital resuscitation rate. The results were as follows:

1) The median prehospital delay time was significantly decreased from 197 minutes to 180 minutes (reduction 10%, 95% CI 6–14%; $p < 0.001$).

2) The re-infarction rate was significantly decreased from 1.2% to 0.7% [Odds Ratio (OR) 0.58 (95% CI 0.36–0.91); $p = 0.021$].

3) Out-of-hospital/prehospital resuscitation rate was significantly increased during the post-intervention period [OR 1.26 (95% CI 1.06–1.54), $p = 0.023$].

Table 3.2 Collective table for the evidence yield by the search

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
1	Kainth et al. (2004). Systematic review of interventions to reduce delay in patients with suspected heart attack. Emergency Medicine Journal, 21(4), 1-6.	Systematic review of experimental studies Level- I	Population: Eleven (11) studies (Two randomized controlled trial, one controlled trial and eight before and after studies).	1) Search methods: The search was conducted in 15 databases with internet and bibliographies of included studies and contact persons to identify any other relevant studies. 2) Study selection: Published in all languages during 1963-2001; studies intervention/campaign was aimed at decreasing the time from the start of signs and symptoms of ACS to look for medical help/hospital arrival, prehospital delay as the result/outcome, and were randomized controlled trials, control trials, or before and after studies. 3) Data extraction and quality assessment: Approved by one observer and checked by another observer, determined discrepancies by discussion and, if necessary, through an alternative third reviewer. Strength was evaluated by a modified checklist Centre for Reviews and Dissemination's (CRD's) Guidance.	5 out of 11 studies showed the interventions to have statistically significant effects on delay time. The results were as follows: 1) Median delay time decreased from 4 to 2.9 hours ($p = 0.007$) (Maeso et al., 2000). 2) Delay time decreased from 3 hours to 2 hours and 20 minutes ($p < 0.001$) (Blohm et al., 1994). 3) Median prehospital delay decreased from 180 minutes to 155 minutes (25 minutes) [$p < 0.001$] (Gaspoz et al., 1996).

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
				4) Data analysis: Evidences was synthesized in a narrative and correct table format.	4) An increase in the percentage of people delayed less than 1 hour from 15.5% to 23.2% ($p = 0.01$) and increase the percentage of people delayed less than 6 hours from 58.5% to 66.0% ($p = 0.05$) (Maeso et al., 2000). 5) An increase in the percentage of people delaying 2 hours or less from 15.8% to 31.3% ($p < 0.05$) (Mitic & Perkins, 1984). In addition, some studies showed an increase in emergency switch board calls and ED visits.

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
2	Mooney et al. (2014). A randomized controlled trial to reduce prehospital delay time in patients with acute coronary syndrome (ACS). The Journal of Emergency Medicine, 46(4), 495-506.	Randomized controlled trial Level- II	Population: 1,944 patients with ACS (972 in each group) admitted in EDs. Setting: Dublin, Ireland (Five tertiary hospitals) Outcome measurement: Time from symptom onset to time of hospital arrival, measured by ACS Response Index.	The educational intervention was based on Leventhal's Self-Regulatory Model of health and illness, and used motivational techniques; hospital-based 40-minute individualized education sessions and reinforcement after 1 and 6 months later by phone and letter respectively, conducted by research nurse. The educational aids were preprinted flip charts and prescriptive content. The intervention was individualized to meet the patient's needs, sickness experiences, ACS symptom variability and onset recognition; patients were instructed to inform someone within 15-30 minutes after symptom onset and use prescribed nitrates; the benefits of timely responses to symptoms and reinforced positive messages were discussed with patients; role-play performed in developing action plans. During the intervention period, patients/relatives/nominees were motivated to make early decisions and take action in help-seeking with ambulance use rather than any other mode of transportation;	The educational intervention achieved a reduction in prehospital delay time and related behaviors in patients with ACS. The results were as follows: 1) The median prehospital delay time was significantly lower at 1.70 hours in the intervention group and 7.10 hours in the control group ($p < 0.001$). 2) The intervention group had a lower rate of discussion with a GP prior to attending the ED ($p < 0.02$). 3) The intervention group had a higher rate of expressing symptoms to another individual within 30 minutes of onset ($p < 0.01$).

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
				discouraged consultation with GP and entrance to the nearest ED in the initial phase of ACS symptoms. At discharge, every patient was given a card and reminder about the key intervention messages including a list of ACS symptoms, ED phone number and location of nearest ED respectively. Followed up after 3, 12 and 24 months by phone.	4) The intervention group had no significant difference in nitrate ($p = 0.06$) or ambulance use ($p = 0.51$).
3	Dracup et al. (2009). A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome. Circulation: Cardiovascular Quality Outcomes, 2(6), 524-532.	Randomized controlled trial Level- II	Population: 3,522 patients with CHD (Experimental: 1,777 & control: 1,745) out-patients. Setting: Out-patient clinic, doctor's office or patient's home.	The education and counseling intervention was based on Leventhal's Self-Regulatory Model of illness behavior; educated patients in the three areas (information, emotional issues and social factors) recommended by National Heart Attack Alert Program. Clinic/community based 40 minutes individualized face-to-face education session and reinforced after 1 and every 6 months later by phone (average 15 minutes), conducted by cardiology expertise nurse. The educational aids, flip charts, were used for both patients and family members; instructed patients about ACS symptoms and possible variability in symptoms	The education and counseling intervention did not statistically decrease prehospital delay time or improvement EMS use, although it significantly increased knowledge, attitudes and beliefs about ACS, response to ACS symptoms and increased the patients' use of aspirin before to reach at the hospital. The result included:

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
			Outcome measurement: Time from symptom onset to hospital arrival, measured by hospital or EMS prehospital medical records.	(e.g. chest discomfort or pain, shortness of breath, diaphoresis etc.) presentation. They were also encouraged to call EMS instantly and take aspirin or nitroglycerin (if prescribed) prior to arrival at hospital. Discussed with the patients about their previous experiences with the medical system; performed role-play to highlight seeking treatment and emotional issues. During the intervention period, deputized spouses, family members or friends to make decisions if the patient hesitated to call EMS. At discharge, every patient was given an advisory form including the right steps to take with initial ACS symptoms. Patients were requested to post the information sheet in a visible place at home (e.g., on the refrigerator or by the phone). Followed up by phone at 3, 12 and 24 months.	1) The median prehospital delay time was not significantly lower 2.20 hours in the experimental group and 2.25 hours in the control group ($p = 0.40$). 2) The experimental group did not significantly increase EMS use ($p = 0.89$). 3) The experimental group significantly increased EMS calls ($p = 0.036$). 4) The experimental group significantly increased taking aspirin following symptom onset ($p = 0.02$).

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
4	Luepker et al. (2000). Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. The Journal of the American Medical Association, 284(1), 60-67	Randomized controlled trial Level- II	Population: 20,364 patients with acute coronary heart disease (Intervention group: 10,563 & control group: 9,801) admitted and discharged patients with CHD related disease. Setting: Twenty United States communities Outcome measurement: Time from symptom onset to ED reach, measured from medical chart.	A theoretically-based, multi-element 18-month program developed to improve ACS treatment by decreasing delay to health care access. The following four strategies were used in this intervention: 1) Community organization where medical or non-medical leaders and organizations in every community formed a local consultative group. The intervention processes were networking, partnership-building and training; 2) Community/public education targeted risk groups of ACS, spouses and families and the public. The following six themes of the public education emerged: building awareness and knowledge of ACS symptoms and proper action, recognition of ACS symptoms, survival plans for ACS, ACS in women, observed reactions to ACS and importance of calling EMS. The intervention processes were mass media, small media, group programs and magnet events; 3) Professional education included doctors, nurses, ED staff, rehabilitation staff and ambulance staff. Intervention	The community intervention reduced delay time but with no significant differences compared to reference communities. However, the intervention did increase the use of EMS. The results were as follows: 1) Delay time significantly reduced in the intervention group (- 4.7% per year, 95% CI, - 8.6% to - 0.6%) but did not differ significantly in the reference or control group (- 6.8% per year, 95% CI, - 14.5% to 1.6%, p = .54). 2) EMS use significantly increased in the intervention group was compared with the reference or control group with a net effect of 20% (95% CI, 7%-34%; p < .005).

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
				processes were continuing education meeting, hospital teams, academic detailing and targeted mailing; 4) Patient education focused on changing patients' knowledge, attitudes, beliefs, behaviors, skills and self-efficacy about quick action for ACS symptoms. Intervention processes were individual counseling, group education, video and print materials, conducted by REACT staff.	
5	Naegeli et al. (2011). Impact of a nationwide public campaign on delays and outcome in Swiss patients with acute coronary syndrome. European Journal of Cardiovascular Prevention & Rehabilitation,	Quasi-experimental study Level- III	Population: 8,906 patients with ACS (Pre-intervention session: 5,006 & post-intervention session: 3,900). Setting: Switzerland	National based public campaign (HELP campaign) conducted by Swiss Heart Foundation, used nationwide AMIS plus patient registry. The intervention aimed at shortening prehospital delay, including improved knowledge and awareness of ACS symptoms, to speed patient contact EMS (calling 144) and to spread skills for resuscitation, and basic life support for people. These topics were covered by a multimedia campaign including television broadcasts, distributed leaflets, promotions, publications, certification and inclusion in school syllabuses. Group CPR training was also arranged for laymen.	The nationwide public campaign was significantly reduced prehospital delay and re-infarction rate. Furthermore, increased the out-of-hospital/prehospital resuscitation rate. The results included: 1) The median prehospital delay time was significantly decreased from 197 minutes to 180 minutes (reduction 10%, 95% CI 6–14%; $p < 0.001$).

Table 3.2 Collective table for the evidence yield by the search (cont.)

No	Authors/Year/ Title/Source of publication	Study design & level of evidence	Population/Setting/ Outcome measurement	Method/Intervention	Results/Outcomes
	18(2), 297-304.		Outcome measurement: Time between symptoms start to hospital admission, measured from questionnaire and AMIS Plus registry.		2) The re-infarction rate significantly decreased from 1.2% to 0.7% [OR 0.58 (95% CI 0.36–0.91); p = 0.021]. 3) Out-of-hospital/prehospital resuscitation rate significantly increased during the post-intervention period [OR 1.26 (95% CI 1.06–1.54), p = 0.023].

3.1.2 Evidence evaluation

All of the selected evidence was appraised by using the method and criteria purposed by Melnyk and Fineout-Overholt (2015) as acknowledged in chapter II. The accuracy of the appraisal was confirmed by the major advisor and co-advisor. According to the evidence levels, one study was level I, three studies were level II and another study was level III. The evidence appraisal process was identified as follows:

The systematic review of experimental studies conducted in line with the objective by appropriate methodology. The selection criteria were explained and the criteria were appropriate. Interpretations of the reviewers were justified and applicable based on the strength of the evidence presented in the review. Nearly half of the studies had clinically and statistically significant results on prehospital delay time in the review. The results are applicable in the author's clinical setting.

Furthermore, all of the experimental studies employed proper methodological procedure. Only one quasi-experimental study by Naegeli et al. (2011) did not employ random assignment. All of the evidence had sufficient sample groups and comparisons in the experimental and control or reference groups. The effectiveness of the interventions was justified by considering both the clinical significance of the results and the statistical significance of the findings. The experimental studies considered p value and/or CI when the research revealed data from the analysis. Two experimental studies (Mooney et al., 2014; Naegeli et al., 2011) had clinically and statistically significant findings on prehospital delay time. The results are applicable in the author's clinical setting. However, two other experimental studies (Dracup et al., 2009; Luepker et al., 2000) had no statistically significant findings on prehospital delay time, even though other positive outcomes were demonstrated. Therefore, these interventions should be cautioned in the author's clinical setting.

3.2 Conclusion

3.2.1 Summary of the selected evidence: Based on the five evidence, one was a systematic review of experimental studies; three were randomized controlled

trials with individualized educational and community intervention; and another was a quasi-experimental study with public educational campaign intervention.

The systematic reviews included 11 studies and all studies evaluated media/public campaign interventions, targeted public groups at risk for ACS with the aim of reducing prehospital delay time; 5 out of 11 studies (one controlled trial and four before and after studies) showed the interventions to have statistically significant results on delay time. Another 5 studies (two randomized controlled trials and three before and after studies) showed no statistically significant results on delay time; and another (before and after study) did not conduct any statistical analysis. Therefore, nearly half of the evidence showed in this review had statistically significant results on delay time. In addition, some evidence showed an increase in emergency switch board calls and ED visits.

Furthermore, based on the other four evidence, the following three types of interventions were encountered: 1) individualized educational interventions; 2) community interventions and 3) public educational campaign interventions were used to reduce prehospital delay in patients with ACS. Each of the interventions is summarized as follows:

1) Individualized educational interventions: The individualized educational interventions were found in two studies aimed at reducing prehospital delay in patients with ACS. One study by Mooney et al. (2014) based on Leventhal's Self-Regulatory Model of health and illness used motivational techniques with 40-minute individualized education sessions and reinforcement by phone and letter at 1 and 6 months, respectively. The intervention was conducted by research nurses. The educational aids were preprinted flip charts and prescriptive scripts. The intervention was a hospital-based intervention targeted at high-risk individuals for both male and female adult patients and their family members after hospital admission and during the discharge period. Followed-up after 3, 12 and 24 months by phone. Outcome measurement was time from symptom onset to time of hospital arrival, measured by the ACS Response Index. The intervention significantly achieved a reduction in prehospital delay time. Furthermore, this intervention successfully altered two important behaviors, namely, a lower rate of discussion with a GP prior to visiting

the ED and a higher rate of expressed symptoms to another individual within 30 minutes of onset.

Furthermore, the other study by Dracup et al. (2009) also based on the same theoretical model with the same intervention and outcome measurement. The intervention was a clinic/community-based intervention targeted at lower-risk individuals for both male and female adult patients who were diagnosed with CHD. The intervention was conducted at the clinics/patients' homes at the patients' convenience. The intervention did not significantly achieve a reduction in prehospital delay time, although it significantly increased knowledge, attitudes, beliefs and response to ACS with increased use of aspirin before reaching the hospital.

Therefore, the evidence revealed that hospital-based individualized educational interventions for patients who are high-risk individuals for ACS incidents are effective in reducing prehospital delay in patients with ACS. Furthermore, the results/outcomes were able to achieve the goal.

2) Community intervention: A theoretically-based, multi element program that used four intervention strategies including community organization, community/public education, professional education and patient education. Different intervention processes were used in this intervention, e.g. networking, partnership-building, training, small/mass media, hospital teams, group education/meeting, video etc. Outcome measurement was time from symptom onset to ED arrival, measured by medical charts. The community intervention reduced delay but achieved no significant difference compared with reference communities, even though the intervention significantly increased the use of EMS. Therefore, community-based intervention was not an effective intervention in changing prehospital delay time in patients with ACS.

3) Public educational campaign interventions: The intervention conducted by the Swiss Heart Foundation used the nationwide AMIS plus patient registry (Radovanovic & Erne, 2010). The main aim of the intervention was to reduce prehospital delay. The intervention targeted the general public. The public campaign was covered by a multimedia campaign including television broadcasts, distributed leaflets, promotions, publications, group CPR training for laymen, certification and inclusion in school syllabuses. The outcome measurement was the

time from symptom onset to hospital admission which was measured by questionnaire and the AMIS plus registry. The public campaign significantly reduced prehospital delay. Furthermore, this intervention reduced re-infarction rates and increased the out-of-hospital/prehospital resuscitation rate. Therefore, public educational campaign interventions are an effective intervention for reducing prehospital delay in patients with ACS.

In conclusion, individualized and public educational campaign interventions can be called effective interventions for reducing prehospital delay in patients with ACS, because both interventions can achieve a reduction in prehospital delay time (Mooney et al., 2014; Naegeli et al., 2011). Furthermore, both interventions reduced re-infarction rates, increased the out-of-hospital/prehospital resuscitation rates (Naegeli et al., 2011) and successfully altered important behaviors in response to symptoms (Mooney et al., 2014).

3.2.2 Recommendations from the studied evidence

The recommendations were derived from the studied evidence yielded by the search on interventions for reducing prehospital delay in patients with ACS. The studied evidence consisted of one systematic review of experimental studies (Level I), three randomized controlled trials (Level II) and one quasi-experimental study (Level III).

According to the analysis and synthesis of the five evidence, two types of interventions are effective at improving prehospital delay in patients with ACS, including individualized and public educational campaign interventions. The recommendations are as follows:

1) Individualized educational interventions for reducing prehospital delay in patients with ACS

1.1 The individualized educational intervention is an effective intervention for reducing prehospital delay in patients with ACS (Mooney et al., 2014/Level II).

1.2 Individualized educational interventions should be hospital-based interventions targeted at high-risk individuals among adult male and

female patients and their family members after hospital admission and during the discharge period (Mooney et al., 2014/Level II).

1.3 Interventions should be composed of three parts including behavior adaptations information, emotional issues and social factors based on the patient's needs, sickness experiences, ACS symptom variability and onset recognition. The education is a 40-minute individualized education session using motivational techniques. The individualized educational intervention should be conducted by a trained nurse. Flip charts and prescriptive content should be used as educational aids (Mooney et al., 2014/Level II).

1.4 Education sessions should be conducted as follows:

Instruct the patients to inform someone within 15-30 minutes after symptom onset and use prescribed nitrates. Explain the benefits of timely responses to symptoms and reinforce positive messages. Then perform role-play in the development of an action plan. Motivate patients and their relatives/nominees to make early decisions and take actions based on their decisions. Encourage help-seeking and ambulance use rather than any other mode of transportation. Discourage consultation with a GP and visiting the nearest ED in the initial phase of ACS symptoms. At discharge, every patient and their family members are provided a card and reminder of the key intervention messages including a list of ACS symptoms, ED phone numbers and location of the nearest ED, respectively. Patients and their family members should be reinforced by phone and letter at 1 and 6 months, respectively (Mooney et al., 2014/Level II).

1.5 Patients and their family members should receive follow-up after discharge for a period of 3, 12 and 24 months (Mooney et al., 2014/Level II).

2) Public educational campaign intervention for reducing prehospital delay in patients with ACS

2.1 Public educational campaign interventions are an effective intervention for reducing prehospital delay in patients with ACS (Kainth et al., 2004/Level I; Naegeli et al., 2011/Level III).

2.2 Public educational campaign interventions should target the general public (Kainth et al., 2004/Level I; Naegeli et al., 2011/Level III) and be

aimed at improving knowledge and awareness of ACS symptoms to accelerate public contact with the ED for ambulance/EMS and to disseminate skills for basic life support to the public. The interventions should be conducted by a health organization (Naegeli et al., 2011/Level III).

2.3 Public educational campaign interventions should be covered by a multimedia campaign including television broadcasts, distributed leaflets, promotions, public dealings, group CPR training for laymen, certification and inclusion in school syllabuses (Naegeli et al., 2011/Level III).

2.4 Public educational campaign sessions should conducted based on the following details:

Educate the public to improve knowledge and awareness of ACS symptoms, and focus on correct and quick intervention to accelerate public contact with the ED for ambulance/EMS. Furthermore, train the public in CPR and widely publicize the use of automated external defibrillators (AED) (Naegeli et al., 2011/Level III).

CHAPTER IV
CONCLUSION AND SUGGESTIONS

4.1 Conclusion

ACS is a major public health problem in every region of the world. In the author's clinical setting in Bangladesh, ACS morbidity and mortality have been increasing gradually and become leading cause of death among adult male and female patients. The morbidity and mortality of ACS depends on the time elapsed from symptom onset to treatment. Time to treatment is shortened if the patients reach hospital early. Therefore, there is a critical need to reduce prehospital delay.

Prehospital delay in patients with ACS is one of the most important issues in Bangladesh. Most Bangladeshi people are not conscious about their health and most have very low levels of knowledge about ACS symptoms. Other problems include shortages of cardiac treatment facilities, professional doctors and nurses, fewer ambulance/transportation facilities, unavailable EMS and no trained EMS providers. Many factors are related to these problems such as socio-demographic, contextual, cognitive and affective, behavioral and clinical factors.

In the author's clinical setting, there is no formal training program for nurses which are specific for prehospital management in ACS. Therefore, nurses may have no sufficient knowledge about prehospital management and do not provide health education for patients regularly. Moreover, nurses do not utilize evidence-based interventions to reduce prehospital delay in ACS. Current scientific evidence is essential to providing updated information, effective interventions and improved patient outcomes. Hence, evidence-based interventions are helpful in reducing prehospital delay in patients with ACS. The aim of this study was to summarize current relevant evidence on interventions aimed at reducing prehospital delay in patients with ACS.

According to the objectives of the study, the author searched for evidence from several electronic databases/sources in the Mahidol University library system and

discovered relevant evidence based on the PICO framework with appropriate use of keywords. The keywords used for the search included “acute coronary syndrome”, “intervention”, “prehospital delay”. The author used a Boolean operator to conduct the search. For each PICO element, the author collected any synonyms by linking terms with “OR”, then located citations relevant to all of the PICO elements by linking with “AND”. After searching, the author found and selected five evidence comprising one systematic review of experimental studies (Level-I), three randomized controlled trials (Level-II) and one quasi-experimental study (Level-III) published in English from 2000 to 2015. The selected evidence was appraised by using the method and criteria purposed by Melnyk and Fineout-Overholt (2015) for answering the following three questions: 1) Are the results of the study valid? 2) What are the results? and 3) Will the results help in caring for patients?.

The evidence revealed that individualized educational and public educational campaign interventions were effective interventions in reducing prehospital delay in patients with ACS. Individualized educational intervention should be hospital-based intervention targeted at high-risk individuals and their family members with 40-minute individualized education sessions using motivational techniques and conducted by trained nurses. Flip charts and prescriptive scripts should be used as educational aids. Performing education sessions should be based on common contents such as instructing patients to inform someone after symptom onset, use of prescribed nitrates, benefits of timely responses to symptoms, importance in improving cognitive and emotional responses, importance of ambulance use rather than any other mode of transportation, etc. Patients and their family members should be reinforced by phone and letter after 1 and 6 months, respectively, and followed up after discharge at intervals of 3, 12 and 24 months. Moreover, public educational campaign interventions should be targeted at the general public, aimed at improving knowledge and raise awareness about ACS symptoms in order to accelerate public contact with ED for ambulance/EMS and disseminate skills for basic life support to the public. Intervention should be conducted by health organizations. The interventions should also be covered by multimedia campaigns including television broadcasts, distributed leaflets, other publications and group CPR training for layman, etc.

It can be concluded that the abovementioned interventions are more significant and effective processes for Bangladesh in reducing prehospital delay in patients with ACS. Therefore, the author has decided that the aforementioned should be implemented in Bangladesh.

4.2 Suggestions

The review of evidence concerning interventions for reducing prehospital delay in patients with ACS suggests that the implementation of interventions should be applied as follows:

4.2.1 Implications for practice

1) The recommendations from the evidence should be implemented to develop clinical practice guidelines on individualized and public educational campaign interventions for reducing prehospital delay in patients with ACS. The guidelines should be applied based on the context of clinical settings in Bangladesh. The resources used to reduce prehospital delay in ACS patients and the methods for arranging individualized and public educational campaign interventions should suit the clinical practice environment. The guidelines should be made simple and easy for nurses, health organizations and general public to practice in real situations. The guidelines should be presented to the official administrators of the clinical setting to gain acceptance and support. Furthermore, this education should be provided for high-risk individuals with ACS and their family members during the discharge period.

2) A training program should be developed for nurses to be equipped with necessary knowledge and skills on individualized educational interventions for reducing prehospital delay in patients with ACS.

A training program should be also designed for multidisciplinary teams including doctors, nurses, healthcare volunteers and community leaders with further training for layman on CPR to improve prehospital resuscitation in local health organizations to equip them with necessary knowledge and skills in public educational campaign intervention. Local health organizations

should provide the public with educational campaigns for the general public in communities with expansion to other communities nationwide.

3) Following implementation, individualized and public educational campaign interventions should be evaluated for effectiveness. If the outcomes are not positive, the guidelines should be modified or improved and implemented.

4) The outcomes of the individualized and public educational campaign interventions for reducing prehospital delay in patients with ACS should be disseminated to healthcare providers, health organizations and the general public through publications in academic journals, internet websites, conferences and seminars to exchange knowledge and continuity of nursing development.

4.2.2 Implications for research

1) A pilot study should be conducted to evaluate the feasibility and effectiveness of implementing the individualized and public educational campaign interventions for reducing prehospital delay in patients with ACS.

2) Few updated experimental studies with strong designs about individualized and public educational campaign interventions for reducing prehospital delay have been conducted in patients with ACS. Furthermore, all of these studies were conducted in the developed countries. No such studies have been conducted in developing countries. Therefore, more experimental research studies with strong designs are recommended to evaluate the effectiveness of individualized and public educational campaign interventions for reducing prehospital delay in patients with ACS in developing countries, including Bangladesh.

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BIOGRAPHY

NAME	Shaibal Kishor Paul
DATE OF BIRTH	1 June 1976
PLACE OF BIRTH	Chittagong, Bangladesh
INSTITUTIONS ATTENDENT	Diploma in Nursing & Diploma in Orthopedic Nursing from Chittagong Nursing Institute, Bangladesh in 1993 to 1996. Bachelor of Science in Nursing from Bangladesh Open University in 2005 to 2007. Master of Nursing Science (Adult Nursing) from Mahidol University, Thailand in 2014 to 2016.
SCHOLARSHIP RECEIVED	Ministry of Health & Family Welfare, Government of the People's Republic of Bangladesh**.**
EMPLOYMENT ADDRESS	Staff Nurse Chittagong 250 Bed General Hospital, Anderkillah, Chittagong, Bangladesh. Tel: + 88-031-616786/634037 e-mail: chittagong@hospi.dghs.gov.bd
HOME ADDRESS	Dhurung, Ward No. 05, Fatickchari, Chittagong, Bangladesh. Tel: + 88-01815698818 e-mail: shaibalkpaul@gmail.com