

Title page

Title: Improving knowledge, attitudes and beliefs about acute coronary syndrome through an individualized educational intervention: a randomized controlled trial.

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Abstract

Objective: To test the effectiveness of an individualized educational intervention on knowledge, attitudes and beliefs about acute coronary syndrome (ACS).

Methods: This multi-site, randomized controlled trial was conducted on 1947 patients with a diagnosis of ACS. Both groups received usual in-hospital education. Participants randomized to the intervention group received a 40-minute one to one individualized education session, delivered using motivational interviewing techniques. The intervention was reinforced one month and six months later. Knowledge, attitudes and beliefs were measured using the ACS Response Index. A total of 1,136 patients (control, n=551; intervention, n=585) completed the questionnaire at baseline, 3 and 12 months. Data were analysed using repeated measures analysis of variance. Ethical approval was obtained.

Results: There was a significant effect of the intervention on mean knowledge ($p<0.001$), attitude ($p=0.003$) and belief ($p<0.001$) scores at 3 and 12 months.

Conclusion: Ensuring patients retain information post education has always been difficult to attain. This study demonstrated that patient education using motivational interviewing techniques and an individualized approach has the potential to alter knowledge, attitudes and beliefs about ACS among a high risk population.

Practice Implications: This relatively short, simple and effective educational intervention could be delivered by nurses in multiple settings.

Key words: knowledge attitudes and beliefs, randomized controlled trial, educational intervention, acute coronary syndrome, motivational interviewing.

1. Introduction

Acute coronary syndrome (ACS) is an umbrella term for a range of clinical symptoms associated with myocardial hypo-perfusion as a consequence of pathological mechanisms [1, 2]. Patients with ACS are classified as ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI) or unstable angina [2]. The adverse effects of ACS include fatal arrhythmias, heart failure and cardiogenic shock [1, 3, 4]. Efficacy and speed are essential if maximum benefits are to be achieved from the therapeutic interventions that are available to patients [5].

The decision to seek care for ACS symptoms is contingent on the individual having the requisite knowledge, attitudes and beliefs about the condition [6]. The literature suggests that knowledge, attitudes and beliefs about ACS is substandard among individuals with a diagnosis of coronary heart disease [7, 8], even among those who had recently experienced an ACS event [9]. While the ACS symptoms, chest pain, arm pain and shortness of breath are relatively well known [9-14], knowledge of other ACS symptoms is less evident [9-11, 13, 15]. Those with inadequate knowledge, attitudes or beliefs about ACS are more susceptible to protracted pre-hospital delay time and a worse prognosis than their speedy counterparts.

To date, eight interventions aimed to improve knowledge, attitudes or beliefs about ACS [7, 8, 14, 16-20]. A summary of these interventions are outlined in Table 1. Six of the eight interventions reported significant improvements in knowledge of ACS symptoms [7, 8, 14, 16, 18, 19]. Of the three researchers who reported on attitudes and beliefs [7, 8, 18], one researcher [8] reported significant improvement in attitudes, while two researchers [8, 18] reported significant improvements in beliefs,

following their intervention. While previous interventions showed promising results, none of these have been conducted in Europe.

Consequently, we decided to test the effectiveness of an individualized educational intervention on knowledge, attitudes and beliefs about ACS in Ireland, using a randomized controlled trial (RCT). It was intended that improvement would expedite help-seeking behaviour in the presence of ACS symptoms. The trial tested the hypothesis that, following the educational intervention, patients in the intervention group will demonstrate greater knowledge, attitudes and beliefs about ACS. The trial was called the 'ACS Response Time Intervention Trial'.

2. Methods

Patients were considered eligible for participation in this multi-site, RCT if they had a provisional diagnosis of ACS, were clinically stable, had access to a telephone and were able to read, understand and communicate in English. Exclusion criteria included those who resided in an institutional setting, had serious complicating co-morbidities or any condition that prohibited them from understanding the intervention. The prohibiting factors were a profound learning disability or a major or uncorrected hearing loss or any neurological disorder that impaired cognition. The study conformed to the Helsinki Declaration and ethical approval was obtained from each of the relevant institutional ethics committees.

2.1. Recruitment

Recruitment took place between October 2007 and October 2009, in the coronary care units and cardiology wards of five tertiary hospitals in Dublin. Eligible patients

who declared an interest in participating in the study were provided with written and verbal about the study. Participant recruitment varied across sites and ranged from 11.4% (n=222) in one hospital to 26.6% (n=518) in the hospital where maximum recruitment was achieved.

2.2. Data collection

Data were collected using the ACS Response Index. This questionnaire [6], which was originally adapted from the REACT trial [21], was used to measure knowledge, attitudes and beliefs about ACS. Validity and reliability have been established for this instrument [6]. Cronbach's α in this trial were: 0.85 (knowledge) 0.65 (attitudes) and 0.63 (beliefs). Knowledge about ACS symptoms was measured on a dichotomous scale of 26 items; five which assessed knowledge of ACS facts (true/false) and 21 which measured recognition of ACS symptoms (yes/no). Six decoy symptoms were included to explore for the possibility that participants would answer "yes" to all items. Knowledge scores were converted to percentage correct for analysis purposes.

Attitudes and beliefs were measured using a four-point Likert-type scale. The attitude scale had five items which measured participants' attitudes towards symptom recognition and confidence in their ability to instigate appropriate help-seeking behaviour in themselves or someone else, if ACS was suspected. Potential scores ranged from 5 to 20. The beliefs scale had nine items that measured participants' beliefs about appropriate responses to ACS symptoms such as getting to the hospital as soon as possible in the presence of unresolved chest pain and using an ambulance to get there. Potential scores ranged from 9 to 36.

The ACS response Index was preceded by a demographic and clinical history questionnaire which sought information about; gender, age, ethnicity, education level, marital status, employment and financial status, level of health insurance and number of dependents. It also included information on participants' previous cardiac history, co-morbidities and cardiac risk factors. Information was obtained from the participants and verified from their medical notes.

Data were collected face-to-face at baseline (prior to the intervention) and by mail at three and 12 months following the intervention. On receipt of completed questionnaires, a follow-up courtesy call was made. This call provided an opportunity to complete any missing data. Follow-up data were collected until the end of November 2010.

2.3 Usual care

Both groups received usual in hospital care. Prior to undertaking the trial, each research site documented what constituted usual in-hospital education for ACS patients. This information indicated that education was not standardized across research sites. Patient education included information on presenting diagnosis, its associated management, medications and secondary prevention education.

2.4. Randomization

Randomization took place on completion of baseline data collection. A computerised random number generator was used to generate random sequences of 50% control and 50% intervention for each research site. Each random sequence was divided into blocks of 20 for each site. Sequentially-numbered, opaque, sealed envelopes were used as the means of group concealment. Following informed consent and

baseline data collection, the sealed envelope with the next sequential study number was opened and the participant's group revealed. Due to the educational nature of the intervention, it was not possible for the interventionist or participant to be blinded to the randomized group at the time of intervention delivery. The postal questionnaires were anonymous and were identified by study number only.

2.5 The Intervention

The intervention was based on Leventhal's self-regulatory model of illness behaviour [22]. It comprised a one-to-one individualized educational session and is described in detail elsewhere [23]. In brief, from a cognitive perspective, detailed information was given about the range, variability and unpredictability of ACS symptoms. Emotions were targeted through raising awareness of emotional responses to symptoms and how these should be handled. This was facilitated through the provision of prepared scenarios that most closely reflected the participant's age, gender and lifestyle. Social factors were addressed through emphasizing the importance of prompt symptom disclosure to a third party. Participants were informed not to delay seeking help in the presence of symptoms and to access the ED directly if symptoms remained unresolved after stopping, resting and using nitrates as prescribed. Motivational interviewing techniques were incorporated into delivery of the intervention message. This technique refers to client-centered counseling, in which the interventionist expresses empathy, rolls with resistance, develops discrepancy and builds self-efficacy [24-28]. An individualized action plan and wallet card with the main intervention messages was given to each participant to take home. The intervention took approximately 40-minutes and was delivered at the bedside or in a room off the ward, within 2-4 days of hospital admission. The intervention group was telephoned one month later to reinforce the intervention. Six months later, a copy of

the action plan was posted to them. While some aspects of the intervention were addressed in usual care, there was greater emphasis on the impact of cognitive, emotional and social factors associated with help-seeking behaviour in the intervention. In addition, the intervention differed from usual care with respect to its duration and use of a theoretical framework.

2.5.1 Intervention fidelity

There was one interventionist recruited to collect data and deliver the intervention at each of the five research sites. Each interventionist received standardized training with respect to the trial design, patient recruitment, data collection, delivery of the intervention and motivational interviewing techniques. The intervention was standardized and the same detailed script, graphics and reinforcement information was used to deliver the intervention across sites. A detailed trial protocol was devised and given to each interventionist. This helped to maximise equivalence within and across research sites. Monthly meetings facilitated on-going coaching to minimize 'drift' in skills and enabled the interventionist to self-report on intervention delivery and data collection procedures [29].

2.6. Statistical Analysis

Data were analyzed using PASW version 18. Descriptive statistics were generated to describe the characteristics of participants and are presented as means (\pm SD) or n (%). Between-group characteristics were compared using chi-square tests for categorical data, the results of which are presented as n (%). Independent samples *t*-tests were used to compare continuous data and are presented as means (\pm SD). The assumption of normality of distribution was assessed by examining histograms

and p - p plots for each continuous variable. For the majority, these were approximately normally distributed. For non-normally distributed variables, Mann Whitney U tests were used to compare medians and are reported as mean, median and interquartile range scores. An alpha of 0.05 was set to control for a Type 1 error rate [30].

Three repeated measures analysis of variance (ANOVA) were used to examine the effect of the intervention on participants' knowledge, attitudes and beliefs over time. For every case of ANOVA the assumption of homogeneity of variances was tested using Mauchly's test of sphericity. When the assumption was violated, Pillai's trace test of significance was used and reported. After adjusting for covariates, estimated marginal means and confidence intervals are presented at all three time points. Paired-samples t -tests were used to make post-hoc comparisons across time for each group for which a Bonferroni adjustment for multiple (six) comparisons was made. Therefore, the significance level was set at $p < 0.008$.

The sample size required to test the study hypothesis was calculated using G* Power 3.1 [31]. Using previously published data [8], the effect size was calculated at 0.225 for knowledge, 0.155 for attitudes and 0.115 for beliefs. Given these effect sizes, an alpha of 0.05 and assuming the use of repeated measures ANOVA using 2 groups (control and intervention) and 3 repetitions (baseline, 3 months & 12 months), it was estimated that sample sizes of 174 (knowledge) 364 (attitudes) and 658 (beliefs) were required to achieve sufficient power (1-beta) to show a significant difference, if it truly existed (95% power).

3. Results

During the recruitment period, 2,041 patients with a provisional diagnosis of ACS were enrolled in the study and randomly assigned to either the control or intervention groups (Figure 1). Of those enrolled, 1,947 had a final diagnosis of ACS and were available for baseline analysis (973 control; 974 intervention). Baseline information on this dataset has been published previously [9]. A total of 1,136 participants completed the ACS Response Index at all three time points (baseline, 3 months and 12 months) - the study cohort.

The mean (\pm SD) age of the study cohort was 63.58 ± 11.2 years. The majority were Irish (97%) and male (72%) (Table 2). The intervention and control groups differed significantly with respect to age, education level, employment status, health insurance and presence of diabetes. The mean age of participants in the control group was significantly higher than the mean age of participants in the intervention group (64.31 versus 62.88; χ^2 , $p=0.03$). Significantly more participants in the intervention group had completed third level education compared with those in the control group (23.6% versus 15.2%; χ^2 , $p<0.01$). Conversely, a significantly higher percentage of participants in the control group were unemployed, retired or on disability (62.6% versus 54.9%; χ^2 , $p=0.01$) did not have private health insurance (67.1% versus 59.5%; χ^2 , $p=0.01$), and were diabetics (18% versus 13.2%; χ^2 , $p=0.03$), compared to those in the intervention group. These factors were controlled for during analysis (Table 2). Demographic and clinical characteristics were compared between the study cohort ($n=1136$) and participants who were either lost to follow-up at 12 months or who had incomplete data ($n=811$) (Table 2).

3.1. The effect of the educational intervention on knowledge, attitudes and beliefs across time

Examination of repeated measures ANOVA revealed that there was a significant difference in knowledge, ($F(2,1111) = 12.750, p < 0.001$ partial $\eta^2 = 0.022$), attitude ($F(2,1111) = 5.111, p = 0.003$, partial $\eta^2 = 0.009$) and belief ($F(2,1111) = 7.361, p < 0.001$, partial $\eta^2 = 0.013$) scores between groups over time, even after controlling for age, education level, employment status, health insurance and diabetes (Table 3). Of the covariates of employment, education, insurance, diabetes and age, none had a significant effect on knowledge, attitude or belief scores with the exception of the covariates education and insurance on belief scores.

There was an interaction between change in belief scores across time and education level ($F = 3.113, p = 0.014$, partial $\eta^2 = 0.006$). Mean belief scores increased from baseline to 3 months, regardless of education level. For participants in the lower education group, belief scores increased slightly more from 3 to 12 months, while scores reduced slightly from 3 to 12 months in those who had some second level education and beyond. There was also an interaction between change in belief scores over time and health insurance ($F = 3.877, p = 0.021$, partial $\eta^2 = 0.007$). Irrespective of health insurance status, mean belief scores increased from baseline to 3 months however for those with private health insurance it reduced slightly between 3 and 12 months, while it remained the same in those with no private health insurance.

Post-hoc pairwise comparison among the time points in each group demonstrated no differences in knowledge score across time in the intervention group ($p > 0.05$ for all time comparisons). Knowledge scores in the control group decreased significantly across time from baseline to 3 months ($t(550) = 4.422, p < 0.001$) and baseline to 12 months ($t(550) = 5.528, p < 0.001$) (Table 4). With respect to attitude scores, these scores increased significantly in the intervention group from baseline to 3 months (t

(584) = -4.829, $p < 0.001$), from 3 months to 12 months ($t(584) = -4.425$, $p < 0.001$) and from baseline to twelve months ($t(584) = -8.185$, $p < 0.001$). In the control group, the only significant difference was an increase in attitude scores from baseline to 12 months ($t(550) = -3.132$, $p < 0.001$) (Table 5). The change in attitude scores in the control group was significantly less than that in the intervention group. With respect to belief scores, there were significant increases in intervention group scores from baseline to 3 months ($t(584) = -11.789$, $p < 0.001$), and from baseline to 12 months ($t(584) = -12.472$, $p < 0.001$). In the control group, there were significant increases in belief scores from baseline to 3 months ($t(550) = -7.211$, $p < 0.001$), and from baseline to 12 months ($t(550) = -8.248$, $p < 0.001$). Belief scores increased faster and to a greater extent in the intervention group compared to the control group (Table 6).

4. Discussion and Conclusion

4.1. Discussion

This is the first European RCT to demonstrate the significant effect of an individualized educational intervention on knowledge, attitudes and beliefs about ACS, over time. It is also the first in Europe to report on all three variables. To synopsise the effect of the intervention, knowledge scores were sustained for the intervention group over 12 months, while they decreased in the control group. Attitude and belief scores were increased in both groups, but the increase was significantly faster and to a greater extent in the intervention group. These changes in knowledge, attitudes and beliefs over time, are generally reflective of those reported internationally [7, 8].

This study is of major clinical significance because individuals with good knowledge of ACS symptoms, who rehearse the correct responses to them, will have an ability to transfer this knowledge into action in the presence of a health threat. In the case of this intervention, the targeted action was to expedite help-seeking behaviour in the presence of ACS symptoms. Therefore, any improvement in knowledge, attitudes and beliefs about ACS is an important step towards achieving this aim. While the RCT design validated the study outcomes, the rationale for the success of the intervention may be attributable to a number of factors. We propose that the use of a theoretical framework, the intervention recipients and the mechanism of intervention delivery are three factors underlying the success of this trial.

The theoretical framework

Consistent with complex intervention criteria [32], this educational intervention was theoretically-based [22, 33]. Theoretically-based education is considered superior to its non-theory based counterpart [34-36]. The majority of previous interventions that targeted knowledge, attitudes and beliefs about ACS were underpinned by a theoretical framework [7, 8, 16-18, 20]. Five of these were based on Leventhal's Self-Regulatory Model of Illness Behaviour [7, 8, 16-18]. As most of these researchers reported successful intervention outcomes [7, 8, 16, 18], the use of Leventhal's Self-Regulatory Model of Illness Behaviour in this study substantiates the effectiveness of the intervention.

Usual in-hospital education tends to be disease specific, with less focus on theory and more on practical skills [35, 37-39]. Thus the theoretically-based intervention differentiated the control and intervention groups in this trial. The intervention targeted cognitive, emotional and social factors as outlined by Leventhal's self-

regulatory model of illness behaviour [40], while usual care tends to target cognition only.

The intervention recipients

This trial differed from previous interventions that targeted knowledge, attitudes and beliefs about ACS with respect to the sample used [7, 8, 14, 16, 18, 19]. To be included in this study, an ACS diagnosis was a pre-requisite; a criterion which differed from previous studies, where inclusion criteria ranged from a diagnosis of coronary heart disease [7, 8, 14, 18, 19] to no diagnosis required [16, 17, 20]. Therefore, the sample in this study was at higher risk for a future cardiac event, relative to the samples included in previous studies.

It is widely known that individuals with a previous cardiac diagnosis are more susceptible to future ACS events [3]. However, those at high risk for a cardiac event can underestimate or reject their risk status and these individuals are often reticent to change their health behaviours [41-44]. Studies that examined the relationship between patients' perceived and actual risk of cardiovascular disease (CVD) reported a tendency towards inappropriate optimism [44]. An accurate risk perception is central to shaping appropriate responses to a health threat [45-47]. The term optimistic bias is sometimes used to describe an unrealistic health-risk perception, whereby individuals tend to interpret symptoms as innocuous, as opposed to life-threatening [44, 48].

Intervention messages are more salient and meaningful for those who identify themselves as being at risk for a recurrent event [44, 49]. During this intervention,

participants' high risk status was discussed. The relevance of the information given may have influenced their uptake and internalization of the intervention. Conversely, it has been suggested that individuals may feel less vulnerable to a future ACS event following surgical revascularization [15]. During this intervention, all participants were informed that they were at risk of a future event, irrespective of their care pathway.

The delivery mechanism

Intervention delivery in this study was standardized, yet adapted to accommodate each participant's personal context. Age, gender, previous history and literacy levels were accounted for. It has been reported that about half of all tailored health-related educational interventions were more effective than those non-tailored [50-53]. Furthermore, tailored interventions have been known to increase the chance of behavioural modification [54-56]. While there is a relative scarcity of empirical evidence to support and evaluate the impact of individualized interventions, it has been suggested that an individualized approach to teaching is well suited to those at greatest risk of symptom development [57-60]. With respect to ACS, individualized education was the means by which the interventions that reported successful outcomes targeted patient education [7, 8, 14, 18, 19].

In this study, the tailored approach to intervention delivery meant that the interventionist focused exclusively on the participant's unique experience of their ACS event. Previous interventions that were tailored to the individual were reported to have been read more frequently and remembered better [51, 61, 62]. Rogers (1983) contends that information will be meaningful and internalized if it is holistically relevant to the person [63]. This infers that individualized interventions are superior

to those that are non-individualized. Thus, the individualization of the intervention in this study may have contributed to its successful outcomes

Motivational interviewing principles were adopted during intervention delivery. Patient's expressions of intention to change during motivational interviewing sessions have been associated with improved outcomes [27, 28]. The involvement of participants and a focus on their unique experience contributed to the expression of empathy. Participants were empowered through improved cognition, which may have contributed to the development of discrepancy and the positive embracement of the intervention message, as a consequence.

Reinforcement of information is thought to produce outcomes that are more resistant to extinction in the short and long term [64]. According to psychologists, reinforcement increases the likelihood of an appropriate response [65, 66] and the more frequently information is recalled, the more likely it is to be retained [67]. In this study, the main intervention messages were reinforced on two occasions; at one month and six months after recruitment.

The control group

Given the success of the educational intervention among the intervention group, the decline in knowledge scores among the control group may be attributable to their non-receipt of the intervention. Some of the commonly known symptoms are widely advertised using media-related health messages, yet these are not always internalized, as people tend to normalize unpleasant information [68]. In this study, the intervention group was protected against normalizing unpleasant information, as

the intervention reinforced their vulnerability for a future event. Furthermore, the intervention included all potential ACS symptoms including those that are not always or easily located within the public realm. This may have contributed to the differentiation in outcomes between the two groups.

Limitations

As with any study there were some limitations. The exclusion of clinically unstable patients meant that knowledge, attitudes and beliefs could not be measured for this cohort. As the majority (97%) of the sample was Irish and Caucasian, the results of the intervention might not be generalisable to other nations, particularly if the intervention uptake was culturally dependent.

4.2. Conclusion

This RCT tested the effectiveness of an individualized educational intervention on ACS patients' knowledge, attitudes and beliefs about ACS. As a consequence of the intervention, baseline knowledge levels were sustained among the intervention group, while those of the control group decreased. There was an increase in attitudes and beliefs in both groups, although the increase was more remarkable among the intervention group. The theoretically-based intervention was delivered using motivational interviewing techniques and targeted a high-risk sample, which added to the originality of this trial. The intervention is practical, adaptable and applicable to the clinical setting. It was effective in improving knowledge, attitudes and beliefs about ACS.

4.3. Practice implications

This intervention sustained knowledge and increased attitude and belief scores about ACS among the intervention group. The content of the intervention emphasized the need to recognise a future ACS event, and how to manage this. This has the potential to improve responses to identified health threats. The intervention took approximately 40 minutes to deliver and could easily be administered by nurses in the clinical setting. It is therefore recommended that this intervention be offered to all individuals who are hospitalized with ACS.

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References

- [1] Karras C, Donlan S, Aitchison R, Aitchison P, Wang E, Kharasch M. Acute coronary syndromes. *Disease a Month*. 2013;59:202-9.
- [2] Hamm CW, Bassand JP, Agewall S, Bax J, Boersma E, Bueno H, et al. ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Eur Heart J*. 2011;32:2999-3054.
- [3] Anderson JL, Adams CD, Antman EM, Bridges CR, Califf RM, Casey Jr DE, et al. ACC/AHA 2007 guidelines for the management of patients with unstable angina/non ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines for the Management of Patients With Unstable Angina/Non ST-Elevation Myocardial Infarction): developed in collaboration with. *Circulation*. 2007;116:e148-304.
- [4] Van de Werf F, Ardissino D, Betriu A, Cokkinos DV, Falk E, Fox KAA, et al. Management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J*. 2003;24:28-66.
- [5] Goldstein P, Wiel E. Management of prehospital thrombolytic therapy in ST-segment elevation in acute coronary syndrome (<12 hours). *Minerva Anesthesiol*. 2005;71:297-302.
- [6] Riegel B, McKinley S, Moser DK, Meischke H, Doering L, Dracup K. Psychometric evaluation of the Acute Coronary Syndrome (ACS) response index. *Res Nurs Health*. 2007;30:584-94.
- [7] Buckley T, McKinley S, Gallagher R, Dracup K, Moser DK, Aitken LM. The effect of education and counselling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. *Eur J Cardiovasc Nurs*. 2007;6:105-11.

- [8] McKinley S, Dracup K, Moser DK, Riegel B, Doering LV, Meischke H, et al. The effect of a short one-on-one nursing intervention on knowledge, attitudes and beliefs related to response to acute coronary syndrome in people with coronary heart disease: A randomized controlled trial. *Int J Nurs Stud.* 2009;46:1037-46.
- [9] O'Brien F, O'Donnell S, McKee G, Mooney M, Moser D. Knowledge, attitudes, and beliefs about acute coronary syndrome in patients diagnosed with ACS: an Irish cross-sectional study. *Eur J Cardiovasc Nurs.* 2013;12:201-8.
- [10] Goff DCJ, Sellers DE, McGovern PG, Meischke H, Goldberg RJ, Bittner V, et al. Knowledge of heart attack symptoms in a population survey in the United States: The REACT trial. *Arch Intern Med.* 1998;158:2329-38.
- [11] Cytryn KN, Yoskowitz NA, Cimino JJ, Patel VL. Lay public's knowledge and decisions in response to symptoms of acute myocardial infarction. *Advances in health sciences education.* 2009;14:43-59.
- [12] Greenlund KJ, Keenan NL, Giles WH, Zheng ZJ, Neff LJ, Croft JB, et al. Public recognition of major signs and symptoms of heart attack: seventeen states and the US Virgin Islands, 2001. *Am Heart J.* 2004;147:1010-6.
- [13] Hwang SY, Ryan CJ, Zerwic JJ. Korean immigrants' knowledge of heart attack symptoms and risk factors. *J Immigr Minor Health.* 2008;10:67-72.
- [14] Gallagher R, Roach K, Belshaw J, Kirkness A, Sadler L, Warrington D. A pre-test post-test study of a brief educational intervention demonstrates improved knowledge of potential acute myocardial infarction symptoms and appropriate responses in cardiac rehabilitation patients. . *Australian Critical Care* 2013;In press.
- [15] Dracup K, McKinley S, Doering LV, Riegel B, Meischke H, Moser DK, et al. Acute coronary syndrome: what do patients know? *Arch Intern Med.* 2008;168:1049.

- [16] Goff DC, Mitchell P, Finnegan J, Pandey D, Bittner V, Feldman HA, et al. Knowledge of heart attack symptoms in 20 US communities. Results from the Rapid Early Action for Coronary Treatment Community Trial. . *Prev Med.* 2004;38: 85-93.
- [17] Meischke H, Diehr P, Rowe S, Cagle A, Eisenberg M. Evaluation of a public education program delivered by firefighters on early recognition of a heart attack. *Eval Health Prof.* 2004;21:3-21.
- [18] Tullmann DF, Haugh KH, Dracup KA, Bourguignon C. A randomized controlled trial to reduce delay in older adults seeking help for symptoms of acute myocardial infarction. *Res Nurs Health.* 2007;30:485-97.
- [19] DeVon HA, Hogan N, Ochs AL, Shapiro M. Time to Treatment for Acute Coronary Syndromes. *J Cardiovasc Nurs.* 2010;25:106-14.
- [20] Mosca L, Hammond G, Mochari-Greenberger H, Towfighi A, Albert MA. Fifteen-Year Trends in Awareness of Heart Disease in Women Results of a 2012 American Heart Association National Survey. *Circulation.* 2013;127:1254-63.
- [21] Luepker RV, Raczynski JM, Osganian S, Goldberg RJ, Finnegan Jr JR, Hedges JR, et al. 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. *JAMA.* 2000;284:60.
- [22] Leventhal H, Cameron L. Behavioral theories and the problem of compliance. *Patient Educ Couns.* 1987;10:117-38.
- [23] Mooney M, McKee G, Fealy G, O'Brien F, O'Donnell S, Moser D. A Randomized Controlled Trial to Reduce Prehospital Delay Time in Patients With Acute Coronary Syndrome (ACS). *The Journal of Emergency Medicine.* 2014.
- [24] Miller W, Rollnick S. *Motivational interviewing: Preparing people for change* Guilford. New York. 2002.

- [25] Levensky ER, Forcehimes A, O'Donohue WT, Beitz K. Motivational Interviewing: An evidence-based approach to counseling helps patients follow treatment recommendations. *The American Journal of Nursing*. 2007;107:50-8.
- [26] Dart M. *Motivational Interviewing in Nursing Practice*. Sudbury, Massachusetts: Jones and Bartlett; 2011.
- [27] Thompson DR, Chan SW, Astin F, Davidson PM, Ski CF. Motivational interviewing: a useful approach to improving cardiovascular health? *J Clin Nurs*. 2011;20:1236-44.
- [28] Watkins CL, Auton MF, Deans CF, Dickinson HA, Jack CI, Lightbody CE, et al. Motivational interviewing early after acute stroke a randomized, controlled trial. *Stroke*. 2007;38:1004-9.
- [29] Borrelli B. The assessment, monitoring and enhancement of treatment fidelity in public health clinical trials. *J Public Health Dent*. 2011;71:s52-s63.
- [30] Warner RM. *Applied statistics: From bivariate through multivariate techniques*. Thousand Oaks, California: Sage; 2008.
- [31] Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behav Res Methods*. 2009;41:1149-60.
- [32] Craig P, Dieppe P, Macintyre S, Mitchie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *British Medical Journal (International Edition)*. 2008;337:979-83.
- [33] Leventhal H, Meyer D, Nerenz D. The common sense representation of illness danger. *Contributions to medical psychology*. 1980;2:7-30.
- [34] Hafner D, Kirscht J. Motivational and behavioural effects of modifying health beliefs. *Public Health Rep*. 1970;85:478-84.

- [35] Petrie KJ, Cameron LD, Ellis CJ, Buick D, Weinman J. Changing illness perceptions after myocardial infarction: an early intervention randomized controlled trial. *Psychosom Med*. 2002;64:580-6.
- [36] Fridlund B, Jönsson A, Andersson E, Bala S-V, Dahlman G-B, Forsberg A, et al. Essentials of nursing care in randomized controlled trials of nurse-led interventions in somatic care: A systematic review. *Open Journal of Nursing*. 2014;4:181.
- [37] Timmins F. A review of the information needs of patients with acute coronary syndromes. *Nurs Crit Care*. 2005;10:174-83.
- [38] Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. *JAMA: the journal of the American Medical Association*. 2002;288:2469-75.
- [39] Maloney L, Weiss M. Patients' perceptions of hospital discharge informational content. *Clin Nurs Res*. 2008;17:200-19.
- [40] Leventhal H, Safer MA, Panagis D. The impact of communications on the self-regulation of health beliefs, decisions and behavior. *Health Educ Q*. 1981;10:4-28.
- [41] Chapman S, Wong WL, Smith W. Self-exempting beliefs about smoking and health: differences between smokers and ex-smokers. *Am J Public Health*. 1993;83:215-9.
- [42] Ayanian JZ, Cleary PD. Perceived risks of heart disease and cancer among cigarette smokers. *JAMA*. 1999;281:1019-21.
- [43] Weinstein ND, Klein WM. Resistance of personal risk perceptions to debiasing interventions. *Health Psychol*. 1995;14:132.
- [44] Weinstein N. What does it mean to understand a risk? Evaluating risk comprehension. *Journal of the National Cancer Institute Monographs*. 1999;25:15-20.

- [45] Furze G, Bull P, Lewin RJ, Thompson DR. Development of the York angina beliefs questionnaire. *Journal of health psychology*. 2003;8:307-15.
- [46] Smith SC, Feldman TE, Hirshfeld JW, Jacobs AK, Kern MJ, King SB, et al. ACC/AHA/SCAI 2005 Guideline Update for Percutaneous Coronary Intervention A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/SCAI Writing Committee to Update the 2001 Guidelines for Percutaneous Coronary Intervention). *J Am Coll Cardiol*. 2006;47:e1-e121.
- [47] Webster R, Heeley E. Perceptions of risk: understanding cardiovascular disease. *Risk Management and Healthcare Policy*. 2010;3:49.
- [48] Scott S, Walter F, Webster A, Sutton S, Emery J. The model of pathways to treatment: conceptualization and integration with existing theory. *British journal of health psychology*. 2013;18:45-65.
- [49] Taylor S. *Health Psychology* London: McGraw Hill; 2006
- [50] Lauver DR, Ward SE, Heidrich SM, Keller ML, Bowers BJ, Brennan PF, et al. Patient-centered interventions. *Res Nurs Health*. 2002;25:246-55.
- [51] Ryan P, Lauver DR. The efficacy of tailored interventions. *J Nurs Scholarsh*. 2002;34:331-7.
- [52] Suhonen R, Välimäki M, Leino-Kilpi H. A review of outcomes of individualised nursing interventions on adult patients. *J Clin Nurs*. 2008;17:843-60.
- [53] Commodore-Mensah Y, Himmelfarb CRD. Patient education strategies for hospitalized cardiovascular patients: a systematic review. *J Cardiovasc Nurs*. 2012;27:154-74.
- [54] Strecher V, Wang C, Derry H, Wildenhaus K, Johnson C. Tailored interventions for multiple risk behaviors. *Health Educ Res*. 2002;17:619-26.

- [55] Alm-Roijer C, Fridlund B, Stagmo M, Erhardt L. Knowing your risk factors for coronary heart disease improves adherence to advice on lifestyle changes and medication. *J Cardiovasc Nurs*. 2006;21:E24-E31.
- [56] Jensen L, Leeman-Castillo B, Coronel SM, Perry D, Belz C, Kapral C, et al. Impact of a nurse telephone intervention among high-cardiovascular-risk, health fair participants. *J Cardiovasc Nurs*. 2009;24:447-53.
- [57] Caldwell MA, Miaskowski C. Mass media interventions to reduce help-seeking delay in people with symptoms of acute myocardial infarction: time for a new approach? *Patient Educ Couns*. 2002;46:1-9.
- [58] Thuresson M, Jarlöv MB, Lindahl B, Svensson L, Zedigh C, Herlitz J. Factors that influence the use of ambulance in acute coronary syndrome. *Am Heart J*. 2008;156:170-6.
- [59] Jankowski P, Bednarek A, Kawecka-Jaszcz K. The influence of educational media campaigns on reduction of prehospital delay in patients with acute coronary syndrome-a systematic review]. *Kardiol Pol*. 2010;68:332.
- [60] Jankowski P, Bednarek A, Surowiec S, Loster M, Pajak A, Kawecka-Jaszcz K. Half of coronary patients are not instructed how to respond to symptoms of a heart attack. *Cardiol J*. 2011;18:668-74.
- [61] De Vries H, Brug J. Computer-tailored interventions motivating people to adopt health promoting behaviours: introduction to a new approach. *Patient Educ Couns*. 1999;36:99-105.
- [62] Skinner CS, Campbell MK, Rimer BK, Curry S, Prochaska JO. How effective is tailored print communication? *Ann Behav Med*. 1999;21:290-8.
- [63] Rogers C. Freedom to learn for the 80s. United States of America: Merrill Publishing 1983.

[64] Passer M, Smith R. Psychology: The Science of Mind and Behavior. 4th Edition. ed. New York.: McGraw-Hill.; 2008.

[65] Skinner B. Beyond freedom and dignity. . New York. : Alfred A. Knopf,; 1971.

[66] Taylor S. Health Psychology. London: McGraw Hill,; 2006.

[67] Gagne R. The Conditions of Learning. . 2nd edn. ed. NewYork. : Holt, Rinehart and Winston Inc.,; 1970.

[68] Alonzo A, Reynolds N. Responding to symptoms and signs of acute myocardial infarction- how do you educate the public? A social- psychologic approach to intervention. Heart Lung. 1997;26:263-72.

Table 1: Summary of interventions aimed at improving knowledge, attitudes or beliefs about ACS

Author, setting & design	Intervention type	Sample	Selected concepts measured Research instrument	Selected results
Goff <i>et al.</i> (2004) United States 1994-1998. Mass media RCT	18 month mass media & multi-component intervention in 20 communities. Symptom recognition and the need to act fast by calling 911	Pre intervention: N= 1,294 Post intervention: N= 1,204	Knowledge of ACS symptoms using open-ended questions. Random digit telephone survey.	Knowledge of symptoms increased in intervention communities ($p<0.001$). No change in knowledge in comparison communities.
Meischke <i>et al.</i> (2004) United States 1998 Individualised RCT	Information kit distributed to increase knowledge of ACS symptoms and the use of 911.	Over 65s (N=323) Intervention=176 Control =147	Knowledge of ACS symptoms and intentions to respond to symptoms. Telephone survey with open-ended questions.	No significant differences in knowledge of symptoms between groups.
Buckley <i>et al.</i> (2007) Australia Individualised RCT	Structured, one-to-one education and counselling intervention.	History of CHD (N=200) Intervention=105 Control=95	Knowledge, attitudes and beliefs at baseline, 3 months and 12 months. The ACS Response Index.	The intervention significantly improved knowledge of ACS over time ($p=0.02$). No significant differences in attitudes and beliefs between groups over time.

Author, setting & design	Intervention type	Sample	Selected concepts measured	Selected results
			Research instrument	
<p>Tullman <i>et al.</i> (2007)</p> <p>United States</p> <p>March - October 2001</p> <p>Individualised RCT.</p>	<p>Structured, one-to-one education and counselling intervention.</p>	<p>Over 65s with history of CHD (N= 115).</p> <p>Intervention=58</p> <p>Control=57</p>	<p>Knowledge, attitudes and beliefs at baseline and 3 months.</p> <p>ACS Response questionnaire.</p>	<p>Significant increase in knowledge ($p<0.001$) and beliefs ($p=0.002$) in the intervention group compared to the control group.</p> <p>No significant differences in attitudes between groups.</p>
<p>McKinley <i>et al.</i> (2009)</p> <p>United States, Australia & New Zealand</p> <p>2001 – 2003.</p> <p>Individualised RCT.</p>	<p>Individualised education and counselling intervention.</p>	<p>CHD (N=3,522).</p> <p>Intervention=1,777</p> <p>Control=1,745</p>	<p>Knowledge, attitudes and beliefs about ACS facts and symptoms</p> <p>ACS Response Index.</p>	<p>Significant increase in knowledge ($p=0.0005$), attitudes ($p=0.0005$) and belief ($p=0.0005$) scores in the intervention group at 3 and 12 months, compared to the control group.</p> <p>Knowledge, attitudes and beliefs were associated with improvements in the other.</p>

Author, setting & design	Intervention type	Sample	Selected concepts measured Research instrument	Selected results
DeVon <i>et al.</i> (2010) United States Dec 2006-March 2008 Pilot RCT	Computerised slide presentation.	Patients with CHD for elective PCI (N=64) Intervention=32 Control=32	Knowledge of ACS symptoms and care seeking behaviour. An identified 20-item instrument.	Knowledge of ACS symptoms and care-seeking behaviour increased significantly in the intervention group, compared to the control group ($p < 0.001$).
Gallagher <i>et al.</i> 2013 Australia. March 2010 to March 2011 Pre-test post-test	Individualised educational intervention.	CHD (N=137)	Knowledge of ACS symptoms and actions. ACS Response Index.	Significantly improvement in mean symptom knowledge ($p < .0001$) Significant improvement in knowledge of actions to take ($p < .001$).

Author, setting & design	Intervention type	Sample	Selected concepts measured	Selected results
			Research instrument	
Mosca <i>et al.</i> (2013) USA 1997-2012. National educational intervention.	Mass media Intervention to increase awareness and educate the public about the hazards of heart disease in women.	Women over 25 (N=>1000)	CVD risk and prevention. American Heart Association National telephone survey using random digit dialing with open-ended questions.	Significant increase in awareness of: nausea ($p<0.0001$) and shortness of breath as ACS symptoms ($p<0.05$) Significant increase in awareness of heart disease as the leading cause of death in women ($p<0.001$).
Legend: RCT- Randomised Controlled Trial, CHD- Coronary Heart Disease, PCI- Percutaneous Coronary Intervention, CVD- Cardiovascular Disease.				

Table 2: Characteristics of trial participants by group and those lost to follow-up at 12 months

Characteristics	Control (n=551) n(%)	Intervention (n=585) n(%)	P value *	No 12 month follow-up	P value †
Age, years-mean ± SD	64.31±11.22	62.88 ±11.13	0.03*	62.65±12.3	0.09
Gender			0.53		0.84
Male	393 (71.3)	427 (73.0)		582(71.8)	
Female	158 (28.7)	158 (27.0)		229(28.2)	
Marital status			0.80		0.02*
Single/widowed/divorced	175 (31.8)	190 (32.5)		302(27.2)	
Married/living with significant other	376 (68.2)	395 (67.5)		509(62.8)	
Education			<0.01*		0.31
Little formal/primary	212 (38.7)	192 (32.8)		310(38.2)	
Second level	254 (46.1)	255 (43.6)		362(44.6)	
Third level	84 (15.2)	138 (23.6)		139(17.1)	
Employment status			0.01*		0.11
Employed/student/looking after home	206 (37.4)	264 (45.1)		364 (45.0)	
Unemployed/retired/disability	345 (62.6)	321 (54.9)		445 (55.0)	
Financial status			0.43		<0.01*
Comfortable	125 (25.8)	151 (29.4)		147 (20.8)	
Enough to make ends meet	310 (63.9)	315 (61.3)		465 (65.8)	
Not enough to make ends meet	50 (10.3)	48 (9.3)		95(13.4)	
Health insurance			0.01*		<0.01*
No private health insurance	361 (67.1)	346 (59.5)		546 (69.0)	
Private health insurance	177 (32.8)	236 (40.5)		245 (31.0)	
Diagnosis			0.13		0.049*
STEMI	150 (27.2)	179 (30.6)		219 (27.0)	
NSTEMI	181 (32.9)	206 (35.2)		320 (39.5)	
Unstable angina	220 (39.9)	200 (34.2)		272 (33.5)	
Previous MI	173 (31.4)	179 (30.6)	0.77	233 (28.7)	0.28
History of Angina	200 (36.3)	196 (33.5)	0.32	266 (32.8)	0.34
Previous PTCA	145 (26.3)	155 (26.5)	0.95	215 (26.5)	0.96
Previous CABG	81 (14.7)	76 (13.0)	0.40	102 (12.6)	0.42
Diabetes	99 (18.0)	77 (13.2)	0.03*	142 (17.5)	0.24
Family history of heart disease	356 (64.6)	396 (67.7)	0.27	524 (64.4)	0.47
Hypercholesterolaemia	406 (73.7)	421 (72.0)	0.51	564 (69.5)	0.12
Hypertension	331 (60.1)	355 (60.7)	0.83	478 (58.4)	0.39
Current smoker	162 (29.4)	161 (27.5)	0.48	306 (37.7)	<0.01*

Legend: Values represent frequencies (percentages) or means ± standard deviation (SD). Age was compared between groups using an independent samples *t*-test. The remainder categorical variables were compared using χ^2 test. * χ^2 test for control vs. intervention at baseline- † χ^2 test for participants with no 12-month follow-up vs. those followed up at 12 months. STEMI = ST segment elevated myocardial infarction; NSTEMI = non-ST segment elevated myocardial infarction; MI = myocardial infarction; PTCA = percutaneous transluminal coronary angioplasty; CABG = coronary artery bypass graft.

Table 3: Knowledge, attitudes and belief scores across time by group (adjusted)

	Control (n=551) Estimated Marginal Mean (CI)	Intervention (n=585) Estimated Marginal Mean (CI)	P value
Knowledge (%)			
Baseline	68.6 (67.1-70.1)	68.9 (67.5-70.3)	<0.001
3 months	65.3 (64.2-66.4)	68.9 (67.8-70.0)	
12 months	64.9 (63.7-66.1)	69.9 (68.7-71.0)	
Attitudes			
Baseline	14.3(14.0-14.6)	14.3 (14.0-14.6)	0.003
3 months	14.5 (14.2-14.8)	14.9 (14.6-15.2)	
12 months	14.7 (14.4-14.9)	15.3 (15.0-15.5)	
Beliefs			
Baseline	27.7(27.4-28.0)	27.7 (27.4-28.0)	<0.001
3 months	28.9 (28.6-29.3)	29.7 (29.3-30.0)	
12 months	28.8 (28.4-29.1)	29.7 (29.3-30.0)	
Legend: CI= Confidence Interval. χ^2 test indicates significance at $p<0.05$ level and shows between group differences over time using repeated measures analysis of variance.			

Table 4: Pairwise comparison of change in knowledge scores among time points for each randomised group

Change in knowledge score at stated time points	Mean difference \pm (SD)	95% Confidence Interval of the difference		<i>t</i>	<i>P</i> value*
		Lower	Upper		
Control group					
Pair 1: baseline - 3 months	2.74 \pm 14.53	1.52	3.95	4.422	<0.001*
Pair 2: 3 months-12 months	0.59 \pm 10.86	-0.32	1.49	1.268	0.21
Pair 3: baseline- 12 months	3.32 \pm 14.11	2.14	4.50	5.528	<0.001*
Intervention group					
Pair 1: baseline- 3 months	-0.30 \pm 16.01	-1.60	1.00	-.447	0.66
Pair 2: 3 months-12 months	-0.76 \pm 10.32	-1.60	0.08	-1.787	0.07
Pair 3: baseline- 12 months	-1.06 \pm 16.49	-2.40	0.28	-1.552	0.12

χ^2 test indicates significance at $p < 0.008$, based on a Bonferroni adjustment for multiple comparisons

Table 5: Pairwise comparison of change in attitude scores among time points for each randomised group

Change in attitude score at stated time points	Mean difference \pm (SD)	95% Confidence Interval of the difference		<i>t</i>	<i>P</i> value*
		Lower	Upper		
Control group					
Pair 1: baseline - 3 months	-0.19 \pm (3.06)	-0.45	0.07	-1.449	0.15
Pair 2:3 months-12 months	-0.23 \pm (2.57)	-0.44	-0.01	-2.069	0.04
Pair 3: baseline-12 months	-0.42 \pm (3.11)	-0.68	-0.15	-3.132	<0.001*
Intervention group					
Pair 1: baseline - 3 months	-0.57 \pm (2.88)	-0.81	-0.34	-4.829	<0.001*
Pair 2: 3 months-12 months	-0.44 \pm (2.42)	-0.64	-0.25	-4.425	<0.001*
Pair 3: baseline- 12 months	-1.02 \pm (3.01)	-1.26	-0.77	-8.185	<0.001*

χ^2 test indicates significance at $p < 0.008$, based on a Bonferroni adjustment for multiple comparisons

Table 6: Pairwise comparison of change in belief scores among time points for each randomised group

Change in belief scores at specified time points	Mean difference \pm (SD)	95% Confidence Interval of the difference		<i>t</i>	<i>P</i> value*
		Lower	Upper		
Control group					
Pair 1: baseline - 3 months	-1.19 \pm (3.87)	-1.51	-0.87	-7.211	<0.001*
Pair 2: 3 months-12 months	-0.13 \pm (3.31)	-0.41	0.14	-0.952	0.34
Pair 3: baseline- 12 months	-1.32 \pm (3.77)	-1.64	-1.01	-8.248	<0.001*
Intervention group					
Pair 1: baseline - 3 months	-1.98 \pm (4.07)	-2.31	-1.65	-11.79	<0.001*
Pair 2: 3 months-12 months	-0.23 \pm (3.43)	-0.51	0.04	-1.65	0.10
Pair 3: baseline- 12 months	-2.22 \pm (4.30)	-2.57	-1.87	-12.47	<0.001*

χ^2 test indicates significance at $p < 0.008$, based on a Bonferroni adjustment for multiple comparisons

