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The Impact of Text Message On Self-Management for Coronary Heart Disease: A Meta-Analysis of Randomized Controlled Trials

Yong Wan, Xin Wu, Yan Kou

Special Survey Dept.(ECG room), Sichuan Luzhou People's Hospital, Luzhou City, Sichuan, P.R.China

ABSTRACT

Introduction: The influence of text message on self-management for coronary heart disease remains controversial. We conducted a systematic review and meta-analysis to explore the impact of text message versus usual care on self-management for coronary heart disease.

Methods: We searched PubMed, EMbase, Web of Science, EBSCO, and Cochrane library databases through July 2018 for randomized controlled trials (RCTs), assessing the effect of text message versus usual care on self-management for coronary heart disease. This meta-analysis is performed using the random-effect model.

Results: Six RCTs involving 1,158 patients are included in the meta-analysis. Overall, compared with a control group for coronary heart disease, text message intervention has no substantial influence on self-efficacy (Std. MD = 2.37; 95% CI = -2.61 to 7.35; *P* = .35), LDL (Std. MD = -1.81; 95% CI = -4.80 to 1.18; *P* = .24), HDL (Std. MD = -1.15; 95% CI = -2.83 to 0.54; *P* = .18), BMI (Std. MD = -3.61; 95% CI = -9.48 to 2.26; *P* = .23), systolic blood pressure (Std. MD = -3.46; 95% CI = -9.03 to 2.12; *P* = .22), diastolic blood pressure (Std. MD = -2.03; 95% CI = -5.90 to 1.85; *P* = .31, non-smoker (RR = 1.12; 95% CI = 0.78 to 1.62; *P* = .53), and physical activity (RR = 1.57; 95% CI = 0.63 to 3.90; *P* = .33).

Conclusions: Text message intervention demonstrates no positive impact on self-efficacy, treatment adherence, and the control of risk factors in patients with coronary heart disease.

INTRODUCTION

Coronary heart diseases are the most common cause of morbidity and mortality among cardiovascular diseases [Sayols-Baixeras 2014; John 2018; Mahonen 2000]. Their incidence rate is 181.4 in every 100,000 individuals, with 46% of mortality cases [Boroumand 2016]. Patients with coronary heart diseases subsequently may suffer from congestive heart failure, cardiac arrhythmias and cardiogenic shock, and require much expense for care and treatment [Brainin 2018; Feng 2018]. The ideal treatments for coronary heart diseases include pharmaceutical, interventional, and surgical measures, management of risk factors, and lifestyle modifications [Bitton 2013; Mohr 2013; Janssen 2013].

Traditional follow-up methods include patients' referral to care centers in person and home visits by health care personnel which require human resources, time, and high expenses [Boroumand 2016]. An efficient, easy, and cost-effective method of telenursing is through text message and telephone [Eng 2014]. Text message is a new, effective, and cost-effective communication method to follow patient status and transference of health information possible in the most remote areas [Boroumand 2016]. Telephone follow-up has emerged as one of the most cost-effective and efficient methods of follow-up in chronic diseases and reduces unnecessary patient visits.

Cognitive–behavioral factors such as self-efficacy can be changed in the promotion of health through lifestyle modification interventions in patients with coronary heart diseases [Cataldo 2013]. Self-efficacy is defined as the individuals' understanding of their own ability to change or continue a behavior successfully [Keefer 2011]. Improved self-efficacy is effective to promote treatment adherence and healthy behaviors of patients [Kang 2013]. The efficacy of text message to improve self-efficacy and other benefits for coronary heart disease has not been well established. Recently, several studies on the topic have been published, and the results have been

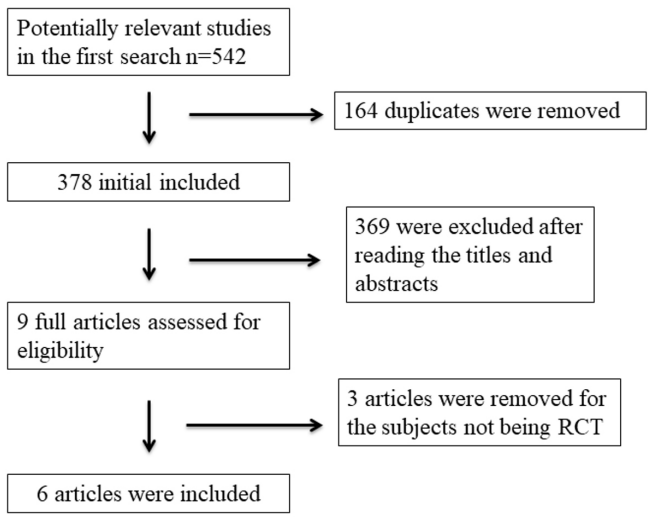

Figure 1. Flow diagram of study searching and selection process.

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Correspondence: Yan Kou, 1 Zhongxiao Road, Jiangyang District, Luzhou City, Sichuan Province, China; 021-63501832; fax: 021-63501832 (e-mail: 905135782@qq.com).

Characteristics of Included Studies

No. Author	Text message group					
	Number	Age (years)	Male (N)	Body mass index (kg/m^2)	Diabetes	Methods
1 Boroumand 2016	32	57.8 ± 7.04	21	-	-	text message and telephone follow-up program for 4 months
2 Pfaeffli Dale 2015	61	59.0 ± 10.5	48	-	14	a personalized 24-week mHealth program, framed in social cognitive theory, sent by fully automated daily short message service text messages and a supporting website
3 Khonsari 2015	31	56 ± 11.3	27	-	-	an automated web-based system managing short message service reminders before every intake of cardiac medications within eight weeks after discharge
4 Frederix 2015	69	61 ± 9	59	28 ± 5	17	an Internet-based, comprehensive, and patient-tailored telerehabilitation program with short message service texting support in combination with conventional cardiac rehabilitation for 24 weeks
5 Chow 2015	352	57.9 ± 9.1	287	29.8 ± 6.0	111	4 text messages per week to change lifestyle behaviors for 6 months
6 Park 2014	30	58.2 ± 10.6	23	29.7 ± 6.8	8	a mobile health intervention delivered customized text messages for 30 days

conflicting [Boroumand 2016; Pfaeffli 2015; Khonsari 2015; Frederix 2015]. With accumulating evidence, we therefore perform a systematic review and meta-analysis of RCTs to investigate the efficacy of text message versus usual care for coronary heart disease.

MATERIALS AND METHODS

Ethical approval and patient consent are not required because this is a systematic review and meta-analysis of previously published studies. The systematic review and meta-analysis are conducted and reported in adherence to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) [Moher 2009].

Search strategy and study selection: Two investigators independently searched the following databases (inception to July 2018): PubMed, EMbase, Web of Science, EBSCO, and Cochrane library databases. The electronic search strategy was conducted using the following keywords: 'text message' and 'coronary disease.' We also checked the reference lists of the screened full-text studies to identify other potentially eligible trials.

The inclusive selection criteria were as follows: (i) population: patients with coronary heart disease; (ii) intervention: text message; (iii) comparison: usual care; and (iv) study design: RCT.

Data extraction and outcome measures: We extracted the following information: author, number of patients, age, male, body mass index (BMI), diabetes, and detail methods in each group etc. Data independently was extracted by two investigators, and discrepancies were resolved by consensus. We also contacted the corresponding author to obtain the data, when necessary. No simplifications and assumptions are made.

The primary outcome is self efficacy. Secondary outcomes include low-density lipoprotein (LDL), high-density lipoprotein (HDL), BMI, systolic blood pressure, diastolic blood pressure, non-smoker, and physical activity.

Quality assessment in individual studies: Methodological quality of the included studies was independently evaluated using the modified Jadad scale [Jadad 1996]. There are 3 items for Jadad scale: randomization (0-2 points), blinding (0-2 points), dropouts and withdrawals (0-1 points). The score of Jadad Scale varies from 0 to 5 points. An article with Jadad score ≤2 is considered to be of low quality. If the Jadad score ≥3, the study is thought to be of high quality [Kjaergard 2001].

STATISTICAL ANALYSIS

We estimate the standard mean difference (Std. MD) with 95% confidence interval (CI) for continuous outcomes (self efficacy, LDL, HDL, BMI, systolic blood pressure, and diastolic blood pressure) and risk ratio (RR) with 95% CIs for dichotomous outcomes (non-smoker and physical activity). A random-effects model is used regardless of heterogeneity. Heterogeneity is reported using the I2 statistic, and I2 > 50% indicates significant heterogeneity [Higgins 2002]. Whenever significant heterogeneity is present, we search for potential sources of heterogeneity via omitting one study in turn for the meta-analysis or performing subgroup analysis. Publication bias is not evaluated because of the limited number (<10) of included studies. All statistical analyses are performed using Review Manager Version 5.3 (The Cochrane Collaboration, Software Update, Oxford, UK).

Characteristics of Included Studies [Cont.]

No. Author	Control group						Jada scores
	Number	Age (years)	Male (N)	Body mass index (kg/m^2)	Diabetes	Methods	
1 Boroumand 2016	32	55.2 ± 9.9	22	-	-	usual care	4
2 Pfaeffli Dale 2015	62	59.9 ± 11.8	52	-	7	usual care	5
3 Khonsari 2015	31	59 ± 13.9	26	-	-	usual care	3
4 Frederix 2015	70	61 ± 8	55	28 ± 4	19	conventional cardiac rehabilitation	4
5 Chow 2015	358	57.3 ± 9.3	295	29.6 ± 5.9	118	usual care	5
6 Park 2014	30	61.1 ± 9.1	25	28.5 ± 5.9	9	usual care	3

RESULTS

Literature search, study characteristics and quality assessment: A detailed flowchart of the search and selection results is shown in Figure 1. Potentially relevant are 542 articles that initially were identified. Finally, 6 RCTs that meet our inclusion criteria are included in the meta-analysis [Boroumand 2016; Pfaeffli 2015; Khonsari 2015; Frederix 2015; Chow 2015; Park 2014].

The baseline characteristics of the 6 eligible RCTs in the meta-analysis are summarized in Table. The 6 studies were published between 2014 and 2016, and sample sizes ranged from 62 to 710 with a total of 1,158. Two RCTs report local injection of methylene blue after traumatic thoracolumbar fixation [Farrokhi 2016], and lumbar open discectomy [Farrokhi 2016]. The detail methods of text message are different in each RCT, and the duration ranges from 1 month to 6 months.

Among the 6 studies included here, 2 studies report self efficacy [Boroumand 2016; Pfaeffli 2015], 2 studies report LDL, HDL and BMI [Pfaeffli 2015, Chow 2015], 3 studies report systolic blood pressure and diastolic blood pressure [Pfaeffli 2015; Frederix 2015; Chow 2015], and 2 studies report non-smoker and physical activity [Pfaeffli 2015; Chow 2015]. Jadad scores of the 6 included studies vary from 4 to 5, and all 6 studies are considered to be high-quality ones according to quality assessment.

Primary outcome: self efficacy. This outcome data is analyzed with the random-effects model, and the pooled estimate of the two included RCTs suggested that compared with the control group for coronary heart disease, text message is not associated with substantially improved self-efficacy (Std. MD = 2.37; 95% CI = -2.61 to 7.35; P = .35) with significant heterogeneity among the studies (I^2 = 99%, heterogeneity P < .00001) (Figure 2).

Sensitivity analysis: Significant heterogeneity is observed among the included studies for the self-efficacy, but there are just 2 RCTs included in the meta-analysis. Thus, we did not perform sensitivity analysis via omitting 1 study in turn or subgroup analysis to detect the heterogeneity.

Secondary outcomes: Compared with the control group for coronary heart disease, text message shows no significant impact on LDL (Std. MD = -1.81; 95% CI = -4.80 to 1.18; P = .24; Figure 3), HDL (Std. MD = -1.15; 95% CI = -2.83 to 0.54; P = .18; Figure 4), BMI (Std. MD = -3.61; 95% CI = -9.48 to 2.26; P = .23; Figure 5), systolic blood pressure (Std. MD = -3.46; 95% CI = -9.03 to 2.12; P = .22; Figure 6), diastolic blood pressure (Std. MD = -2.03; 95% CI = -5.90 to 1.85; P = .31; Figure 7), non-smoker (RR = 1.12; 95% CI = 0.78 to 1.62; P = .53; Figure 8), and physical activity (RR = 1.57; 95% CI = 0.63 to 3.90; P = .33; Figure 9).

DISCUSSION

Mobile phone text message-based interventions have been reported to be a potential means of modifying health behaviors [Fjeldsoe 2009]. Some studies reveal its efficacy to change individual health behaviors of smoking, weight loss, and physical activity to improve medical management of diabetes, and medication adherence [Franklin 2006]. Text messaging delivering via mobile phone intervention has particular value and obtains wide population effects, without the requirement of a smartphone. Health and mobile health interventions have easy scalability owing to affordability and ability to deliver personalized services [Lester 2010; Franklin 2015].

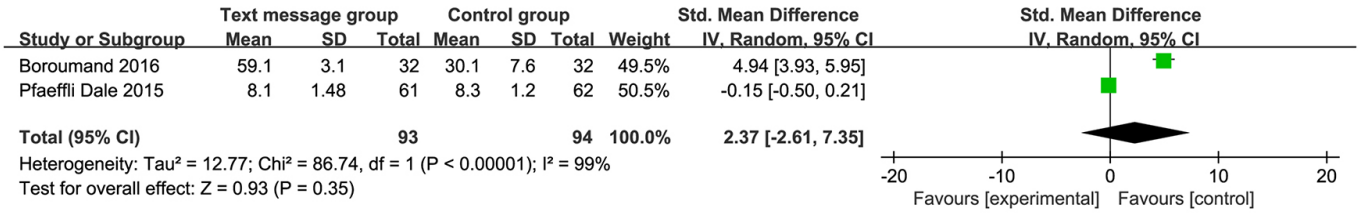

Figure 2. Forest plot for the meta-analysis of self efficacy.

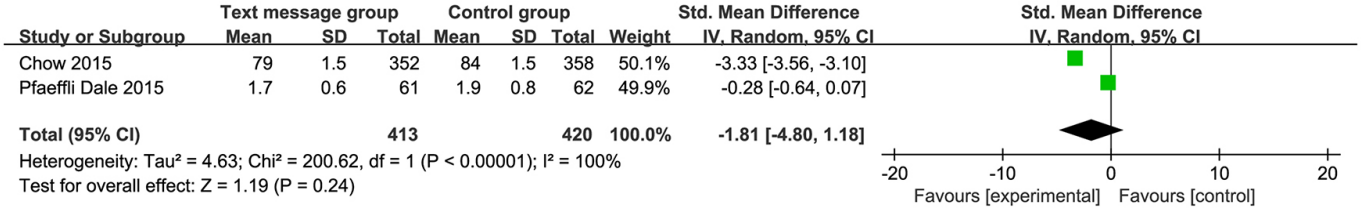

Figure 3. Forest plot for the meta-analysis of low-density lipoprotein (LDL).

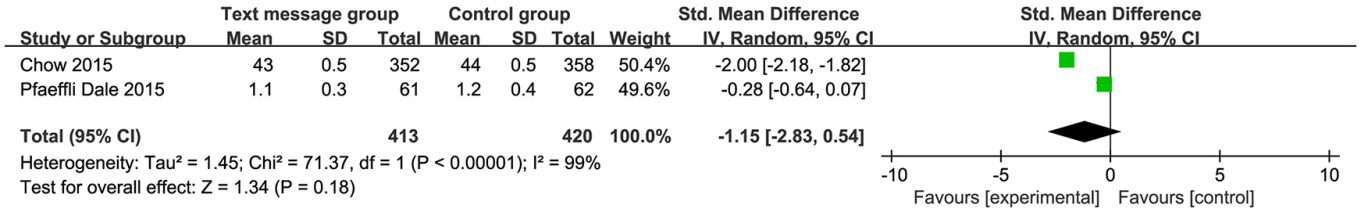

Figure 4. Forest plot for the meta-analysis of high-density lipoprotein (HDL).

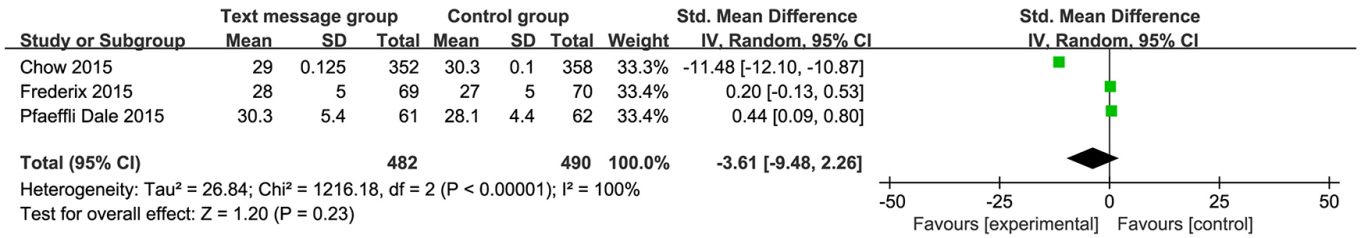

Figure 5. Forest plot for the meta-analysis of BMI.

Many clinical trials have shown the effectiveness of mobile phone text messaging to promote weight loss, physical activity, glycemic control in diabetes, and medication adherence [Franklin 2006; Lester 2010; Patrick 2009; Hurling 2007]. In one RCT involving 70 patients with coronary heart disease, cardiac self-efficacy score significantly is increased after 3 and 4 months of text message intervention [Boroumand 2016]. One study exploring the effect of a text message-based weight loss program on weight loss and dietary habits of overweight individuals finds that text message intervention has a greater reduction in weight and improvement in dietary habits compared with a control group [Norman 2013]. Text message intervention provides important benefits for physical activity self-efficacy, and frequency and duration of physical activity 6 weeks and 6 months after the intervention [Furber 2010].

However, in another study, text message and telephone follow-up of cardiac patients with diabetes shows no significant difference of self-efficacy and self-care behavior between the intervention and control groups [Wu 2012]. One study aims to explore the efficacy of a text message intervention on medication adherence in patients with coronary heart disease, and the results reveal no significant difference between

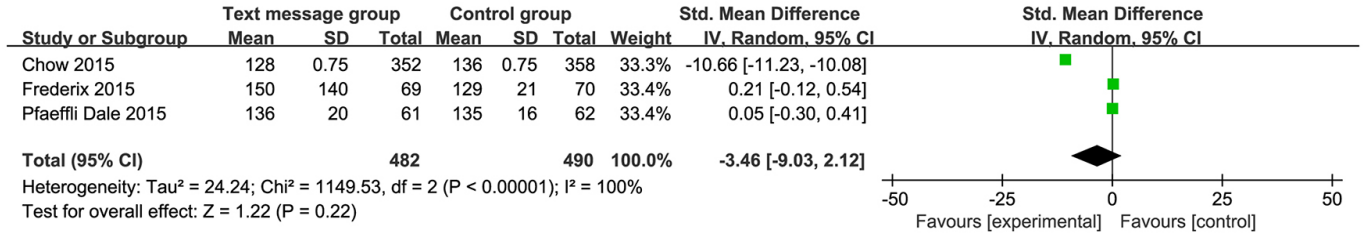

Figure 6. Forest plot for the meta-analysis of systolic blood pressure.

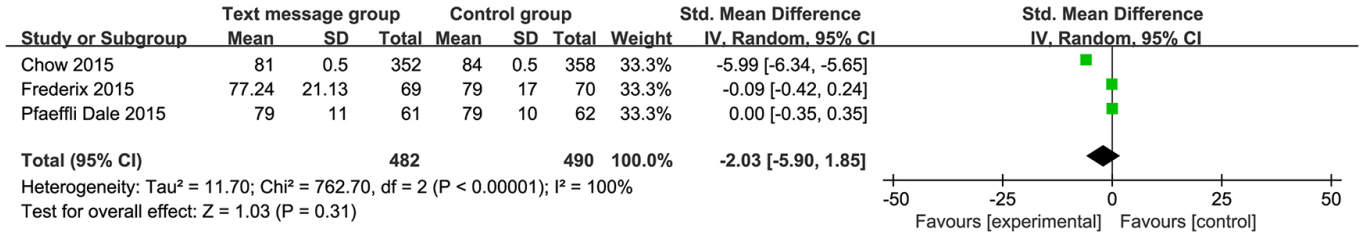

Figure 7. Forest plot for the meta-analysis of diastolic blood pressure.

Figure 8. Forest plot for the meta-analysis of non-smoker.

Figure 9. Forest plot for the meta-analysis of physical activity.

text message intervention and control group in terms of self-efficacy in correct use of medication dose [Park 2014].

Our meta-analysis suggests that text message shows no additional benefits of self-efficacy, the number of non-smoker, and physical activity compared with the control group for coronary heart disease. The risk factors for coronary heart disease are evaluated by LDL and HDL level, BMI, systolic and diastolic blood pressure. In our meta-analysis, there is no significant difference of these indexes between the two groups. Regarding the sensitivity, there is significant heterogeneity. Several reasons may explain it. First, different evaluation score systems are applied for the same index, such as self efficacy [Boroumand 2016; Pfaeffli 2015]. Second, detail methods of text message are various in each RCT. Third, the duration of text message ranges from 30 days to 6 months, which may have some impact on the pooling results.

This meta-analysis has several potential limitations that should be taken into account. First, our analysis is based on only 6 RCTs and 3 of them have a relatively small sample size (N < 100). More RCTs with large samples should be conducted

to explore this issue. There is significant heterogeneity, different methods and duration of text message intervention, as well as evaluation score systems in included RCTs may have an influence on the pooling results. Finally, some unpublished and missing data might lead bias to the pooled effect.

CONCLUSION

Text message intervention has no remarkable beneficial effects on coronary heart disease.

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