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Collaborative care intervention for patients with chronic heart failure

A systematic review and meta-analysis

Xiaoting Cui, MS[a,*], Wenyi Dong, BS[b], Hongxiao Zheng, BS[a], Haiyan Li, BS[a]

Abstract

Introduction: Patients with chronic heart failure (HF) show many symptoms that worsen the quality of life (QoL). Collaborative care intervention (CCI) aims to improve the QoL and symptoms by integrating psychosocial and palliative strategies in chronic care.

Methods: The PubMed, EMBASE, and Cochrane library databases were searched from inception to September 2018. The included studies were used to determine pooled standard mean differences (SMDs) and associated 95% confidence intervals (CIs). The data were assessed by fixed- and random effects models, respectively.

Results: Twenty-one studies including 2999 patients with chronic heart failure were included. The results showed significantly improved QoL in the CCI group compared with the routine care group (SMD=0.60, 95%CI 0.27–0.94, $P_{\text{heterogeneity}} < .001$, $I^2 = 94.1\%$). The patients who received face-to-face interventions experienced a significant improvement (SMD=0.54, 95%CI 0.24–0.85, $P_{\text{heterogeneity}} < .001$, $I^2 = 88.7\%$) in terms of QoL compared with those administered only telephone interventions. Furthermore, significantly improved anxiety level (SMD=0.33, 95%CI 0.12–0.55, $P_{\text{heterogeneity}} = .612$, $I^2 = 0\%$) and 6-min walk test (SMD=0.46, 95%CI 0.29–0.64, $P_{\text{heterogeneity}} = .458$, $I^2 = 0\%$) were found in the CCI group compared with the routine care group.

Conclusion: These findings confirmed that collaborative care intervention effectively improves the quality of life as well as psychological (anxiety) and physical (6-min walk test) functions in patients with chronic heart failure compared with routine care. Furthermore, face-to-face interventions show a greater improvement of QoL compared with telephone-only interventions.

Abbreviations: CCI = Collaborative care intervention, CIs = confidence intervals, HF = heart failure, QoL = quality of life, RCTs = randomized controlled trials, SMDs = standard mean differences.

Keywords: collaborative care intervention, heart failure, meta-analysis, quality of life, systematic review

1. Introduction

Heart failure (HF) is a global public health issue affecting between 1% and 2% of adults, and more than 10% of individuals over the age of 70.[1] Morbidity is expected to continuously rise due to demographic changes and the increasing incidence rates of HF risk factors, including hypertension, ischemic heart disease, smoking and diabetes. HF has similar morbidity and mortality as many types of cancer, conferring a lower quality of life than most chronic diseases. In Europe, HF affects more than 15 million individuals, and global HF prevalence is expected to rise by 25% by 2030.[2] Currently, the prevalence of HF among adults in Europe and the United States ranges from 0.4% to 2.3%.[3] Left ventricular myocardial function, dysfunctions of valves, the endocardium, the pericardium, and the myocardium, and altered heart rhythm are associated with HF. These ailments, together with multiple comorbidities, often lead to chronic HF.

HF is a chronic disease with a wide range of effects, almost affecting every important aspect of a patient's life. Consequently, patients with HF experience impaired quality of life (QoL) as well as psychological distress. Severe depressive disorder is a common manifestation of HF, in coping with pain in the patients.[4] Meanwhile increased QoL impairment and depressive symptoms are associated with adverse HF disease trajectories and poor clinical outcomes. These symptoms tend to persist, although the best guidelines are based on the management of HF, and a symptom-oriented approach to palliative care may be beneficial. Although there are multiple compelling palliative care requirements in HF, the patients are generally not examined by palliative care experts in outpatient clinics, since the number of palliative care experts is limited.[5]

To address these challenges, collaborative care intervention (CCI) was developed based on (1) evidence showing potentially modifiable contributors to QoL[6]; (2) primary concerns and needs of patients and informal caregivers, and preferences for palliative care[7]; (3) a successful model of health care delivery. Currently, the effect of collaborative care intervention in patients

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XC and WD contributed equally to this work.

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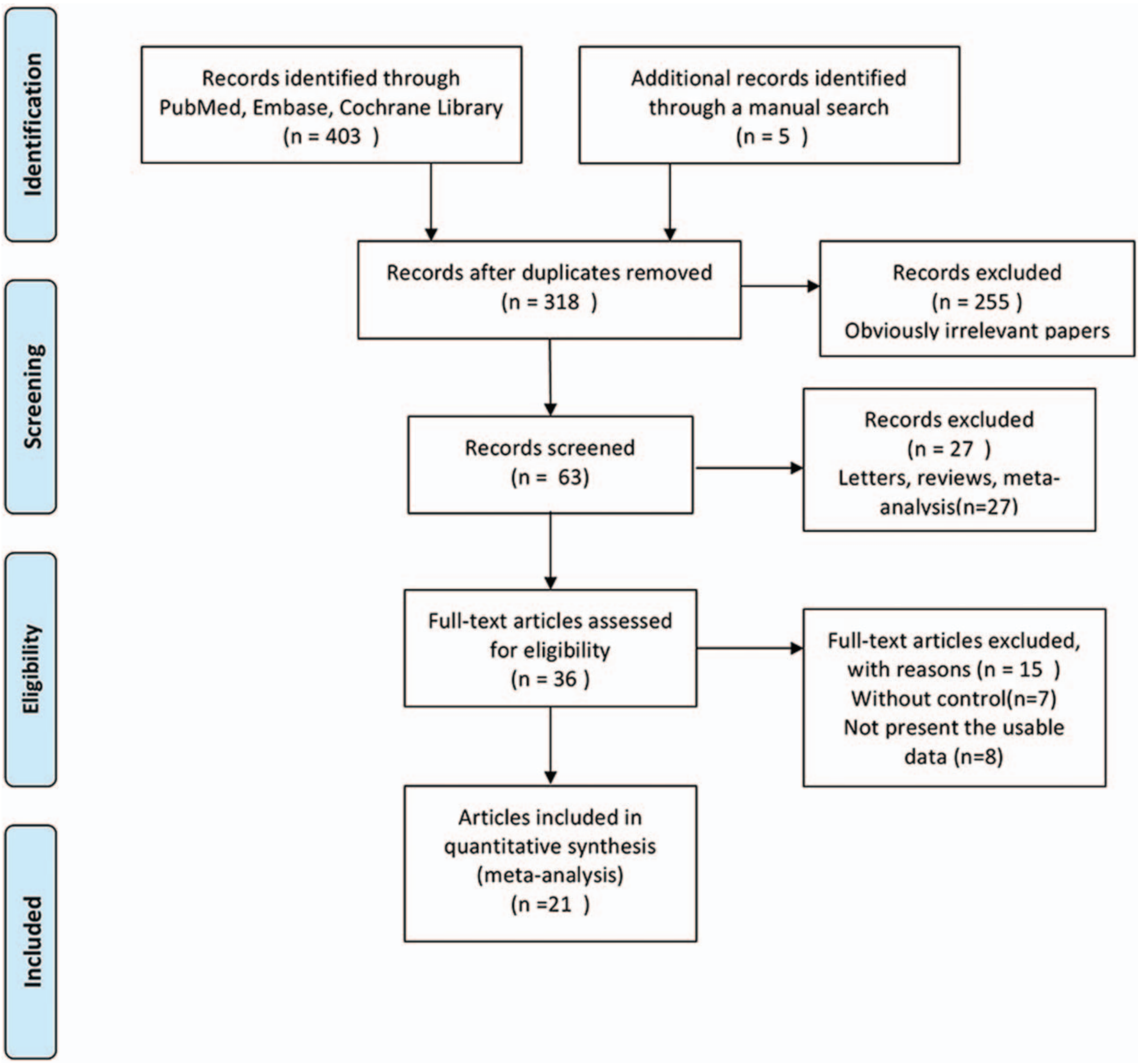


Figure 1. Flow diagram of study identification.

with chronic heart failure is largely undefined. Therefore, we performed a systematic review and meta-analysis of published studies to provide a comprehensive assessment of the efficacy of collaborative care intervention in patients with chronic heart failure.

2. Methods

The present meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines. The meta-analysis based on public literature is not applicable for ethical approval.

2.1. Search strategy

Two investigators independently searched for eligible studies assessing the effect of collaborative care intervention in patients with chronic heart failure. Studies published from inception to September 2018 were identified via an electronic search of the PubMed, EmBase, and Cochrane Library databases without language restriction. The keywords used were: (collaborative care intervention or psychosocial intervention or multidisciplinary or comprehensive care) and (chronic heart failure) and randomized controlled trial. The references of all identified publications were also searched for additional eligible studies.

2.2. Inclusion and exclusion criteria

Collaborative care intervention is defined in this study as a collaborative symptom care provided by a nurse and psychosocial care provided by health professionals that is focused on improving the psychologic and/or social aspects of a patient's health. The included studies met the following criteria in the present meta analysis: (1) evaluation of the effect of collaborative care intervention in patients with chronic heart failure, (2) randomized controlled trial, and (3) publication in the English language; (4) sufficient data to determine the level of quality of life. Studies were excluded for the following reasons: (1) absence

Table 1

Characteristics of studies included in this meta-analysis.

				Group			
Author/year of publication	**Country**	**Sample size**	**Mean age, years (Intervention, Control)**	**Intervention**	**Control**	**Follow-up time**	**Outcomes assessed**
Rich/1995	USA	282	80.1,78.4	142	140	3M	Quality of life
Cline/1998	Sweden	190	75.1,76	80	110	12M	Quality of life
Varma/1999	Northern Ireland	83	73.1,76.3	42	41	12M	Quality of life
Jaarsma/2000	USA	132	72,72	58	74	9M	Quality of life
Lusignan/2001	UK	20	75.2,75.2	10	10	12M	Quality of life
Harrison/2002	Canada	192	75.7,75.5	100	92	3M	Quality of life
Doughty/2002	USA	197	72.5,73.5	100	97	12M	Quality of life
Kasper/2002	USA	200	60.2,63.7	102	98	6M	Quality of life
Luskin/2002	USA	29	66,66	14	15	2.5M	Quality of life, anxiety, 6-min-walk
Goldberg/2003	USA	280	57.9,60.2	138	142	6M	Quality of life
Naylor/2004	USA	239	76.4,75.6	118	121	13M	Quality of life
Austin/2005	UK	200	71.8,71.9	100	100	6M	Quality of life, 6-min-walk
Chang/2005	USA	63	69.7,69.2	34	29	4.75M	Quality of life
Riegel/2006	USA	134	71.6,72.7	69	65	6M	Quality of life
Gary/2010	USA	32	NA	17	15	6M	Quality of life, 6-min-walk
Yu/2010	China	121	74.9,77.4	59	62	3.5M	Quality of life
Dunbar/2015	USA	134	57.7,57	70	64	6M	Quality of life, 6-min-walk
Wang/2015	China	92	63.2,68.3	47	45	3M	Quality of life
Rogers/2017	USA	150	69.8,71.9	75	75	6M	Quality of life, anxiety
Lang/2018	UK	50	71.8,76	25	25	6M	Quality of life, anxiety
Sherwood/2018	USA	179	57.6,57.9	89	90	36M	Quality of life, anxiety, 6-min-walk

NA = not available, UK = the United Kingdom, USA = the United States of America.

of control subjects, (2) nonclinical studies, (3) reviews, abstracts, or conference papers, and (4) duplicate publication.

2.3. Data extraction and quality assessment

All available data were extracted from each study by two investigators independently based on the above inclusion criteria. Any disagreement was resolved through discussion with a third investigator. The following information was extracted from the included studies: first author's name, year of publication, country, mean patient age, intervention group, control group, follow-up time, and outcomes assessed. The quality of the randomized controlled trials (RCTs) included was evaluated using the Cochrane Collaboration's tool for assessing the risk of bias.[8] The assessment included the following components: random sequence generation, allocation concealment, blinding of patients and study personnel, blinding of outcome assessment, completeness of outcome data, selective reporting of outcomes, and other bias to validity.

2.4. Data pooling and analyses

The current meta-analysis was conducted with Stata 12 (StataCorp, College Station, TX, USA). Standard mean differences (SMDs) and corresponding 95% confidence intervals (CIs) were obtained for continuous data. Heterogeneity across each effect size was evaluated by the Q-statistic and the I^2 index. $I^2 > 50\%$ indicated statistically significant heterogeneity; in this case, the random-effects model was used for analyses. Otherwise, the summary effect was computed using the fixed-effects model. The relative influence of each study on the pooled estimate was assessed by omitting one study at a time for sensitivity analysis. The Stata^{SE} 12 software was used to generate funnel plots, and the Begg's and Egger's tests were performed to quantify publication bias. Significant publication bias was defined as two-sided $P < .05$. The trim and fill method was applied in case of publication bias.

3. Results

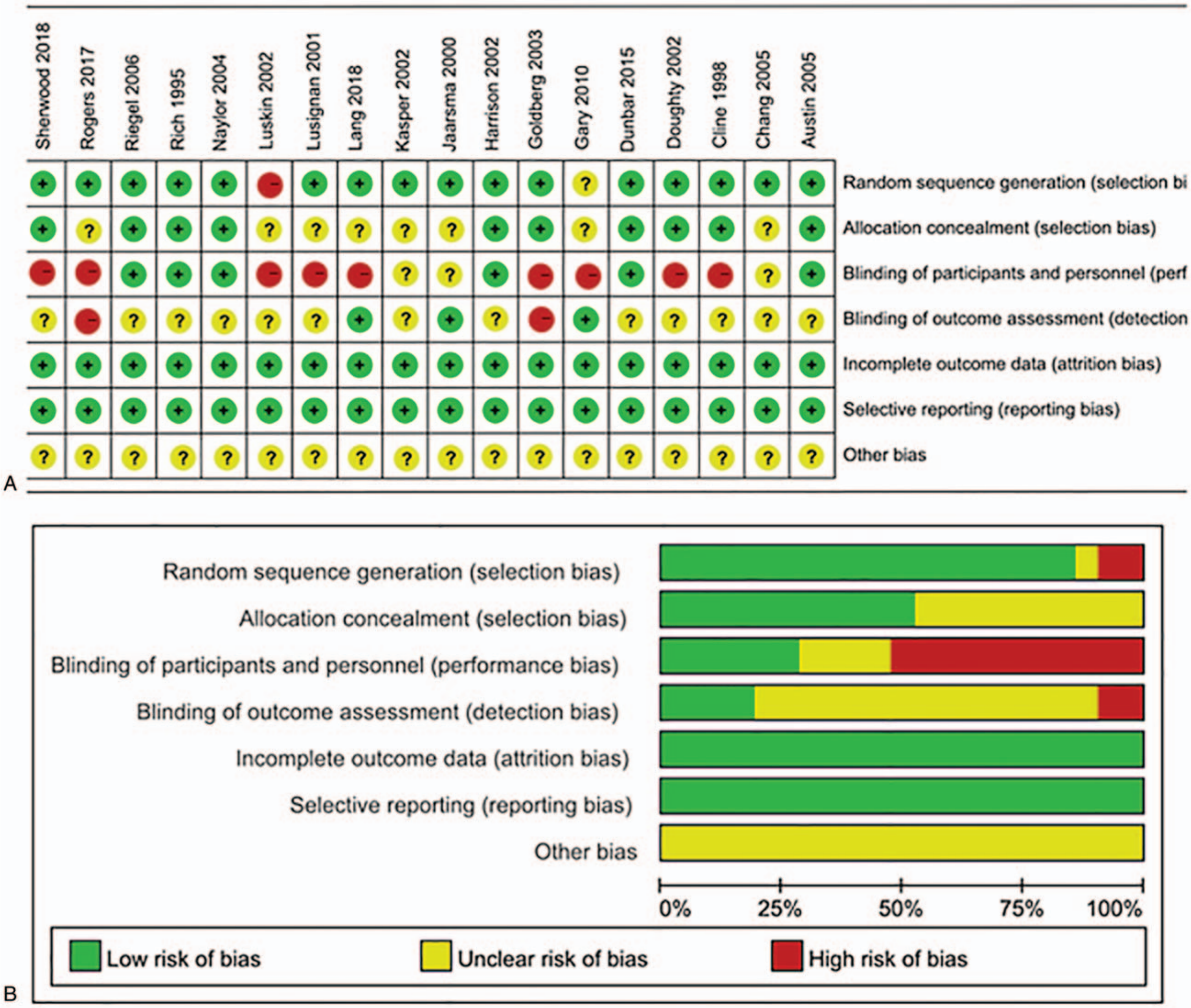
3.1. Study selection and trial characteristics

Figure 1 graphically illustrates the study flow chart. The literature search yielded 403 potentially relevant articles. Then, five additional records were found by hand searching of reference lists of other review articles. According to inclusion criteria, 318 studies remained after removing duplicates. After screening the titles and abstracts, 255 articles were excluded because of obvious irrelevance. Of the remaining 63 reports, 27 articles were excluded as letters, reviews, and meta-analyses. After reading the full texts of the 36 remaining articles, 15 reports were excluded for the following reasons: lack of controls ($n = 7$); no usable data ($n = 8$). Thus, 21 articles[9–29] (21 independent randomized controlled trials), involving 2999 randomized patients contained sufficient data to be included in the current meta-analysis. The data collected from the included studies are summarized in Table 1. The studies were performed in a variety of countries, and sample sizes ranged from 20 to 282 patients. The mean patient age ranged from 57 to 80.1 years. A summary of the risk of bias for each included study is found in Figure 2. All included studies were randomized, but two studies used restricted randomization.

Eleven studies had no blinding of patients or the personnel. Although blinding of outcome assessors was not explicitly indicated, two studies had a risk of detection bias. Allocation concealment was not mentioned in any of the studies, so potential selection bias may be present.

3.2. Quantitative analysis

3.2.1. *Quality of life.* All 21 studies evaluated the effect of collaborative care intervention on the QoL of patients with



	Sherwood 2018	Rogers 2017	Riegel 2006	Rich 1995	Naylor 2004	Luskin 2002	Lusignan 2001	Lang 2018	Kasper 2002	Jaarsma 2000	Harrison 2002	Goldberg 2003	Gary 2010	Dunbar 2015	Doughty 2002	Cline 1998	Chang 2005	Austin 2005
Random sequence generation (selection bi	+	+	+	+	+	-	+	+	+	+	+	+	?	+	+	+	+	+
Allocation concealment (selection bias)	+	?	+	+	+	?	?	?	?	?	+	+	?	+	+	+	?	+
Blinding of participants and personnel (perf	-	-	+	+	+	-	-	-	?	?	+	-	-	+	-	-	?	+
Blinding of outcome assessment (detection	?	-	?	?	?	?	?	+	?	+	?	-	+	?	?	?	?	?
Incomplete outcome data (attrition bias)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Selective reporting (reporting bias)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Other bias	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

Figure 2. Risk of bias assessment for the randomized trials included in the meta-analysis. (A) Summary; (B) Graph. Symbols: (+), low risk of bias; (?), unclear risk of bias; (-), high risk of bias.

chronic heart failure. Pooled analysis was performed with the available data comparing 1489 intervention patients with 1510 controls. Significantly improved QoL was found in the CCI group compared with the routine care group (SMD=0.60, 95%CI 0.27–0.94, $P_{\text{heterogeneity}} < .001$, $I^2 = 94.1\%$) (Fig. 3A). To assess the sources of heterogeneity, further subgroup analyses were performed. Similarly, significantly improved QoL was found in patients administered multidisciplinary intervention (SMD=0.63, 95%CI 0.14–1.11, $P_{\text{heterogeneity}} < .001$, $I^2 = 92.6\%$) (Fig. 3B) and those who received only non-multidisciplinary intervention (SMD=0.59, 95%CI 0.11–1.06, $P_{\text{heterogeneity}} < .001$, $I^2 = 95.2\%$) (Fig. 3B); significant heterogeneity was observed in the two comparison groups. However, patients administered face-to-face interventions experienced a significant improvement (SMD=0.54, 95%CI 0.24–0.85, $P_{\text{heterogeneity}} < .001$, $I^2 = 88.7\%$) (Fig. 3C) in terms of QoL compared with those who received telephone-only interventions.

3.2.2. Anxiety level. Four studies examined the effect of collaborative care intervention on anxiety level in patients with chronic heart failure. Pooled analysis was performed with the available data comparing 203 intervention patients with 205 controls. Significantly improved anxiety level was found in the CCI group compared with the routine care group (SMD=0.33, 95%CI 0.12–0.55, $P_{\text{heterogeneity}} = .612$, $I^2 = 0\%$) (Fig. 4A).

3.2.3. Six-min walk. Five studies assessed the effect of collaborative care intervention on 6-min walk test in patients with chronic heart failure. Pooled analysis was performed with the available data comparing 290 intervention patients with 284 controls. Significantly improved 6-min walk test was obtained in the CCI group compared with the routine care group (SMD=0.46, 95%CI 0.29–0.64, $P_{\text{heterogeneity}} = .458$, $I^2 = 0\%$) (Fig. 4B).

3.3. Sensitivity

To evaluate the stability of results, sensitivity analysis was performed, with one study removed from the analysis at a time. As shown in Figure 5, the corresponding pooled results did not significantly change, regardless of which study was removed, suggesting that the results were robust.

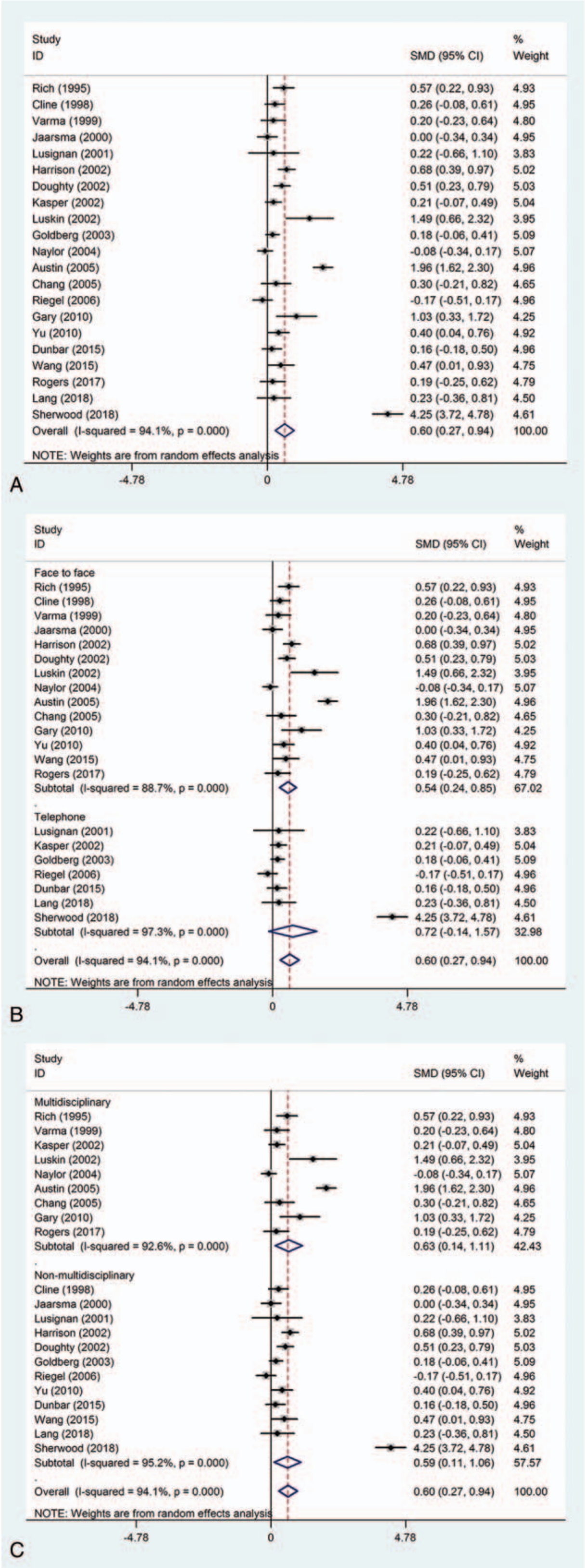


Figure 3. Effect of collaborative care intervention on the QoL of patients with chronic heart failure. (A) Total; (B) Intervention types; (C) Team types.

3.4. Publication bias

In this meta-analysis, publication bias was assessed by the Begg's and Egger's tests, respectively. The Begg's test revealed the existence of publication bias for QoL (Begg's test $P=.027$; Egger's test $P=.156$) (Fig. 6). The cut and fill method showed no need for additional literature (Figure S1, http://links.lww.com/MD/C901).

4. Discussion

To the best of our knowledge, this is the largest study so far analyzing data from 21 trials with 2999 participants and evaluating the efficacy of collaborative care intervention in patients with chronic heart failure. Our results showed that collaborative care intervention effectively improved the QoL, anxiety level and physical function (6-min walk test) compared with routine care intervention. Furthermore, face-to-face interventions conferred a greater improvement of the QoL compared with telephone-only interventions. The efficacy of psychosocial intervention in patients with chronic heart failure have been assessed in previous meta-analyses. Recently, Samartzis et al.[30] performed a meta-analysis of psychosocial intervention in patients with chronic heart failure, and demonstrated that psychosocial intervention is an efficacious means of QoL improvement. Compared with Samartzis' work, we included more eligible studies[25–29] and performed a comprehensive analysis of psychological and physical functions, as well as the quality of life, while Samartzis et al. only focused on QoL. Furthermore, Samartzis et al. only consisted of 16 studies, while the current study analyzed data from 21 studies. Our results showed that collaborative care intervention not only improved QoL, but also ameliorated psychological (anxiety) and physical (6-min walk test) functions.

Patients with heart failure often report high levels of mental distress and decreased quality of life (QoL). Therefore, interventions improving their QoL and other positive psychosocial outcomes are needed. Effective interventions include multidisciplinary approaches; repeated face-to-face contact; patient education with a focus on self-care, weight monitoring and medication; and proactive drug optimization rather than relying solely on patient triggers. Structured assessments by telephone or remote monitoring may be inefficient as they mainly focus on HF, which accounts for less than half of all readmissions. This lack of effectiveness of remote support has also been demonstrated in large medical RCTs assessing high-risk HF patients. Strategies including face-to-face assessments may be more effective than remote monitoring in addressing noncardiovascular conditions, which account for about 40% of readmissions. This study also demonstrated that face-to-face interventions resulted in greater improvement of the QoL compared with telephone-only interventions. Anxiety is a common mood disorder in patients with heart failure, which may impair functional ability and aggravate symptoms. This in turn leads to social aggregation, as well as the inability of patients to learn about and care for their disease. About 40% of HF patients suffer from major anxiety. In this study, we found that collaborative

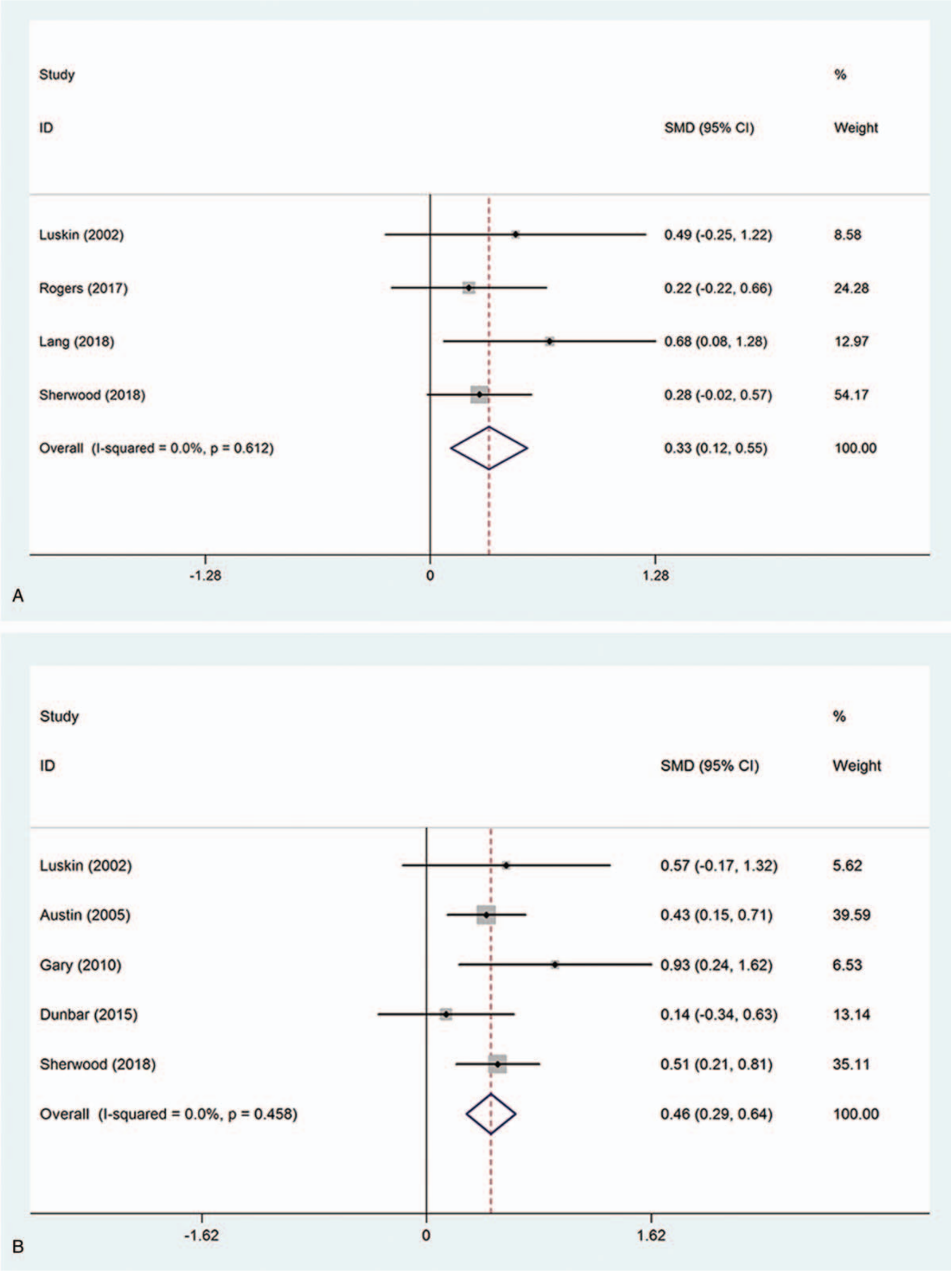


Figure 4. Effect of collaborative care intervention on psychological and physical functions in patients with chronic heart failure. (A) Anxiety level; (B) 6-min walk test.

care intervention effectively improved anxiety compared with routine care intervention.

Several limitations should be kept in mind while interpreting the current results. Firstly, meta-analyses may be biased when the literature search fails to identify all relevant trials or in case selection criteria for including a trial are applied in a subjective manner. Secondly, language can also introduce a bias. Specifically, we only selected English reports, and other eligible studies were excluded. Thirdly, there is potential publication bias in this study since we did not take into consideration some unpublished papers and abstracts, whose data were not available to us. Fourthly, some clinical items which interfere with QoL, such as age, type of HF (preserved or reduced EF), length of the disease, comorbidities, etc. Finally, several studies had small sample sizes

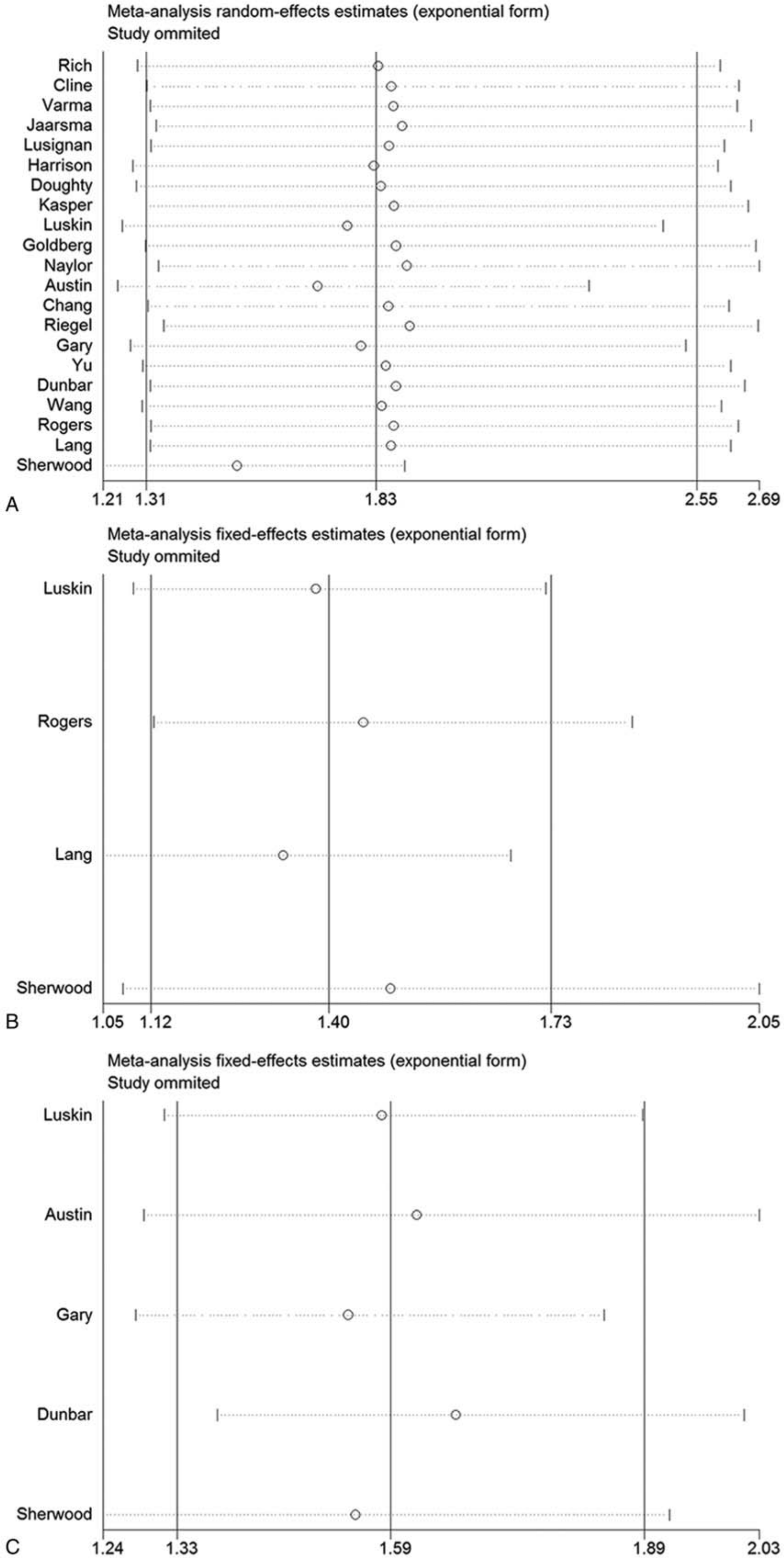


Figure 5. Sensitivity analysis of the effect of collaborative care intervention in patients with chronic heart failure. (A) Quality of life; (B) Anxiety level; (C) 6-min walk test.

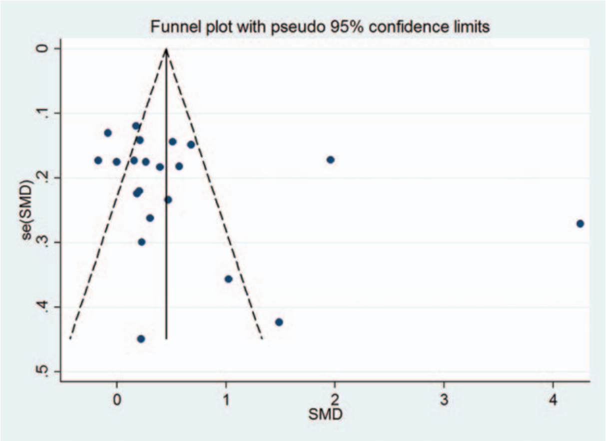


Figure 6. Funnel plot for publication bias assessment. Each point represents a separate study for the indicated association.

and short follow-up periods, which might reduce the statistical power of this meta-analysis.

In conclusion, despite its limitations, this meta-analysis confirmed that collaborative care intervention effectively improved the quality of life, and psychological (anxiety) and physical (6-min walk test) functions in patients with chronic heart failure compared with routine intervention. Furthermore, face-to-face interventions resulted in a greater improvement of the QoL compared with telephone-only interventions.

Author contributions

Conceptualization: Xiaoting Cui.
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Investigation: Wenyi Dong, Haiyan Li.
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Supervision: Xiaoting Cui.
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Visualization: Hongxiao Zheng.
Writing – original draft: Xiaoting Cui, Wenyi Dong.
Writing – review & editing: Xiaoting Cui, Wenyi Dong, Hongxiao Zheng, Haiyan Li.

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