Patient Education and Counseling 99 (2016) 1087–1098

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.elsevier.com/locate/pateducou

Review article

Identifying components of self-management interventions that improve health-related quality of life in chronically ill patients: Systematic review and meta-regression analysis

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ARTICLE INFO

Article history:
Received 22 October 2015
Received in revised form 14 January 2016
Accepted 29 January 2016

Keywords:
Chronic heart failure
Chronic obstructive pulmonary disease
Complex interventions
Meta-regression
Self-management
Systematic review
Type 2 diabetes mellitus

ABSTRACT

Objective: To quantify diversity in components of self-management interventions and explore which components are associated with improvement in health-related quality of life (HRQoL) in patients with chronic heart failure (CHF), chronic obstructive pulmonary disease (COPD), or type 2 diabetes mellitus (T2DM).

Methods: Systematic literature search was conducted from January 1985 through June 2013. Included studies were randomised trials in patients with CHF, COPD, or T2DM, comparing self-management interventions with usual care, and reporting data on disease-specific HRQoL. Data were analysed with weighted random effects linear regression models.

Results: 47 trials were included, representing 10,596 patients. Self-management interventions showed great diversity in mode, content, intensity, and duration. Although self-management interventions overall improved HRQoL at 6 and 12 months, meta-regression showed counterintuitive negative effects of standardised training of interventionists (SMD = −0.16, 95% CI: −0.31 to −0.01) and peer interaction (SMD = −0.23, 95% CI: −0.39 to 0.06) on HRQoL at 6 months.

Conclusion: Self-management interventions improve HRQoL at 6 and 12 months, but interventions evaluated are highly heterogeneous. No components were identified that favourably affected HRQoL. Standardised training and peer interaction negatively influenced HRQoL, but the underlying mechanism remains unclear.

Practice implications: Future research should address process evaluations and study response to self-management on the level of individual patients.

Contents

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http://dx.doi.org/10.1016/j.pec.2016.01.022
0738-3991/

1. Introduction

The rising number of people with a chronic condition [1] has led to increasing enthusiasm for self-management approaches, in which patients are encouraged to take on a primary role in managing the daily care of their chronic condition. Through self-management interventions, patients are equipped with essential skills to actively participate in self-management behaviour and manage their condition successfully [2].

Accumulating evidence in systematic reviews and meta-analyses points to favourable effects of self-management interventions in patients with various chronic conditions, such as arthritis [3], asthma [4], chronic heart failure (CHF) [5], chronic obstructive pulmonary disease (COPD) [6], and type 2 diabetes mellitus (T2DM) [7,8]. However, several systematic reviews reported inconclusive results for one or more outcomes reviewed [4–8]. An explanation for the discrepancies in trial findings may be the large variability amongst self-management interventions delivered: they generally consist of multiple interrelated components, with large differences in content, intensity and mode of delivery, and are therefore considered so-called complex interventions. A crucial question is whether particular components of those complex interventions, often shared by several chronic conditions, may be responsible for eliciting positive effects, i.e. being the active ingredients of the intervention [9].

The majority of the chronically ill patients is faced with one or more comorbid conditions [10]. Furthermore, the large proportions of non-complying and non-responding patients in trials in different chronic conditions [11] suggest that adherence to and uptake of interventions might be applicable to chronic conditions at large and transcend specific conditions. This leads to the expectation that specific components of interventions exert their effects irrespective of the clinical condition a patient is facing. For example, the presumed positive influence of peers for social comparison [12] may enhance self-management skills similarly in patients with various chronic conditions, such as COPD or T2DM. Similarly, the acquisition of problem-solving skills to reduce the impact of a chronic condition on daily living may exert similar positive effects on well-being in patients with T2DM and patients with arthritis.

Despite these considerations, few attempts have been made to systematically study the effect of such components of self-management interventions across chronic conditions. Meta-regression techniques are an appealing approach to address this issue, as they enable an exploration of the heterogeneity in effect sizes [13], particularly for factors that differ across studies, such as specific intervention components [14]. Only two previous meta-regressions have tried to identify essential intervention components in self-management interventions in various chronic conditions [15,16]. One revealed that face-to-face contact with patients was associated with improved physical outcomes in patients with arthritis, asthma, or T2DM [16], while the other could not identify any intervention component that improved outcomes in patients with T2DM, hypertension, or osteoarthritis [15]. Both studies concluded that the mechanism through which self-management interventions work remained unclear.

Both previous meta-regressions focused on physiological outcomes for their analyses. Although these outcomes are clinically relevant, a crucial outcome for patients living with a chronic condition is health-related quality of life (HRQoL) as it measures the impact of the chronic condition on their daily lives. This notion is recognised as it is increasingly being measured in trials as a (co-) primary outcome, mainly through the use of disease-specific scales [17]. Evaluating success of self-management interventions in terms of improvements in HRQoL therefore seems more appropriate from a patient's perspective.

The aim of this study was to quantify the diversity in components of self-management interventions and explore through a meta-regression which intervention components affect improvements in HRQoL across three major chronic conditions (CHF, COPD, or T2DM). Since the prognosis and management of the three chronic conditions differ, our secondary aim was to study the association of intervention components with improvements in HRQoL for each condition separately.

2. Methods

2.1. Research design

This study was a systematic review and meta-regression of published studies and adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) criteria [18].

2.2. Literature search

An extensive literature search has been conducted in the electronic databases of PubMed, EMBASE, CENTRAL, PsycINFO and CINAHL from January 1985 through June 2013. MeSH terms and key words in title/abstract used were "chronic heart failure"; "chronic obstructive pulmonary disease"; "diabetes mellitus type 2"; "self-management"; "patient-education"; "randomised controlled trial"; and synonyms (see Appendix Table A.1 in Supplementary material for the complete PubMed search strategy). Reference lists of relevant systematic reviews were hand-searched and experts in the domain were consulted to ensure complete coverage of relevant studies.

2.3. Study selection

Initial selection based on title/abstract was conducted by one researcher. The full texts of potentially relevant studies were

retrieved for further assessment by two researchers to minimise selective selection. Discrepancies in selection were discussed in the presence of a third researcher to reach agreement.

Since there is no general agreement on an operational definition of what constitutes a self-management intervention [19], an international group of seven experts reached consensus during a conference meeting on essential components for defining 'self-management interventions'. In addition to education about the condition, an intervention was required to have a minimum of two of the following components to be meet the definition of 'self-management intervention': (1) stimulation of sign/symptom monitoring, (2) education in problem solving skills (i.e. managing

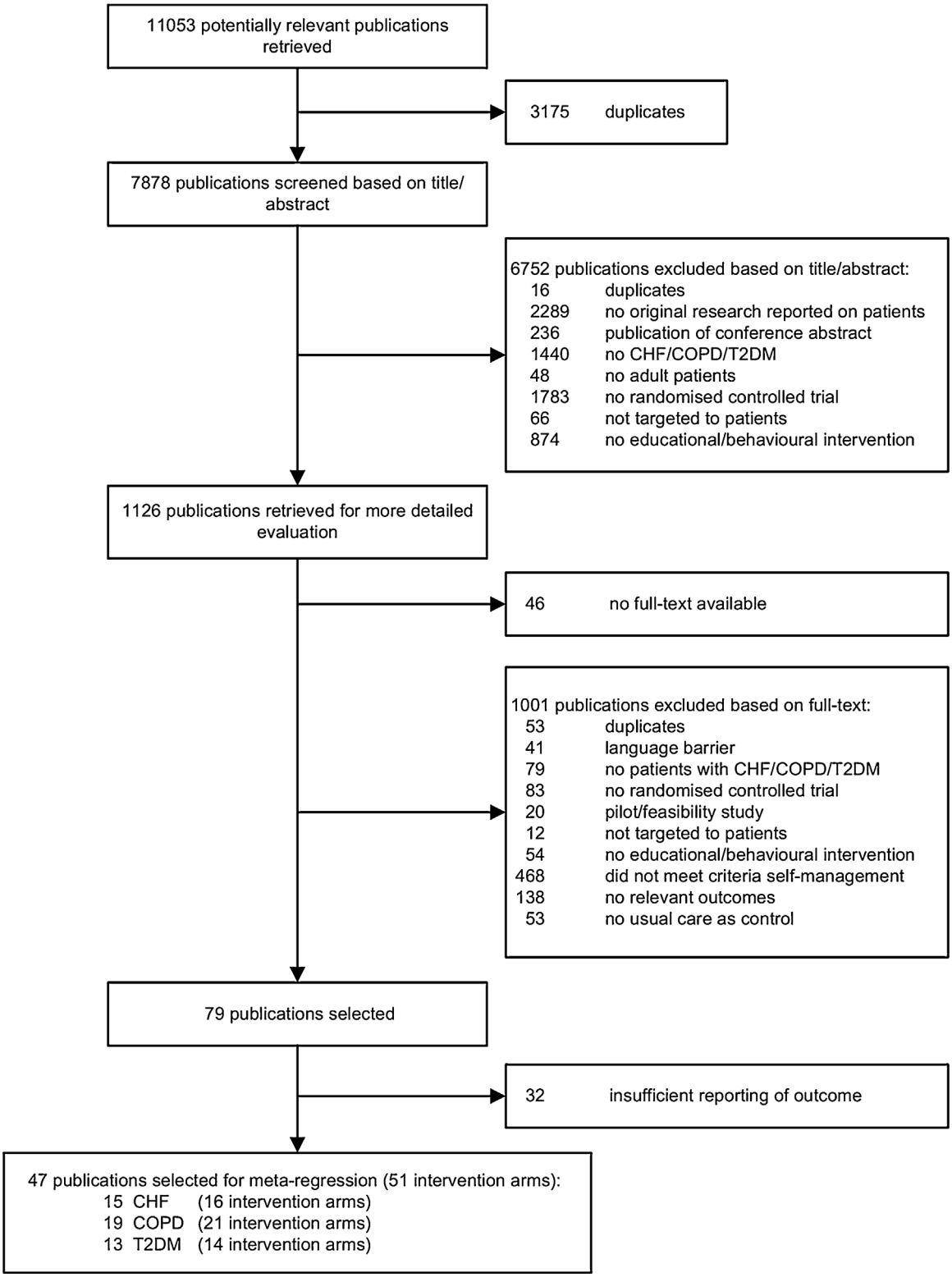

Fig. 1. Flowchart of the selection of studies for the meta-regression of self-management interventions for chronically ill patients.
CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; T2DM = type 2 diabetes mellitus.

Table 1
Description of studies included in the meta-regression of self-management interventions for chronically ill patients.

Study	Country	*N* (control/ SM arms)	Recruitment	Mean age	% female	Training interventionist	Total no. of all contacts	Programme duration (months)	Mode	Content	HRQoL instrument	Time-points (months)
Chronic heart failure												
Bruggink-Andre de la Porte et al. [26]	Netherlands	122/118	Hospital	70.5	27	Heterogeneous	9	12	KL	SA, MP, LS	MLWHFQ	3, 12
Cline et al. [27]	Sweden	110/80	Hospital	75.6	47	Heterogeneous	4	8	KL	SA	QLQ-HF	12
Dewalt et al. [28]	USA	65/62	Hospital	62.5	51	Heterogeneous	11	6	KL	GS, PS, SA	MLWHFQ	12
Ojeda et al. [29]	Spain	77/76	Hospital	65.0	39	Heterogeneous	5	12		LS	MLWHFQ	16
Otsu et al. [30]	Japan	52/52	Hospital	73.1	37	Standardised	6	6	KL	SA, MP, LS	MacNew	6, 12
Peters-Klimm et al. [31]	Germany	100/97	Primary care	69.6	27	Standardised	14	12	KL	GS, PS	KCCQ	12
Prasun et al. [32]	USA	31/35	Hospital	67.3	35	Heterogeneous	1	1 day	KL		MLWHFQ	3
Ramachandran et al. [33]	India	25/25	Hospital	44.6	22	Heterogeneous	27	6	PI, KL	LS	KCCQ	6
Rich et al. [34]	USA	140/142	Hospital	79.3	64	Heterogeneous	11	3	KL	SA, MP	CHQ	3
Riegel et al. [35]	USA	65/70	Hospital	72.1	54	Standardised	13.5	6		PS, SA	MLWHFQ	6
Shively et al. [36]	USA	58/58	Hospital	67.4	5	Standardised	7	4	PI, KL	GS, SA, LS	MLWHFQ	4, 16
Sisk et al. [37]	USA	203/203	Hospital	59.5	46	Standardised	6	6		SA,LS	MLWHFQ	12
Smeulders [38]	Netherlands	131/186	Hospital	66.7	28	Standardised	6	1.5	PI	GS, PS, SA, MP, LS	KCCQ	6, 12
Varma et al. [39]	Northern Ireland	41/42	Primary care	75.9	59	Heterogeneous	5	12	KL	SA	MLWHFQ	6,12
Wakefield et al. [40][a]	USA	49/47/ 52	Hospital	69.3	1	Heterogeneous	14	3	KL	GS, SA	MLWHFQ	6
Chronic obstructive pulmonary disease												
Bischoff et al. [41]	Netherlands	55/55	Primary care	64.5	41	Standardised	8	6		PS, SA, MP, LS	CRQ	6
Bourbeau et al. [42]	Canada	95/96	Hospital	69.5	45	Standardised	25	12		PS, SA, MP	SGRQ	4, 12
Bucknall et al. [43]	United Kingdom	232/232	Hospital	69.2	64	Standardised	20.8	12	KL	PS, SA, MP, LS	SGRQ	12
Coultas et al. [44][a]	USA	73/72/ 72	Primary care	69.1	57	Standardised	7 (arm 1) 8 (arm 2)	6			SGRQ	6
Efraimsson et al. [45]	Sweden	26/26	Primary care	66.5	50	Standardised	2	3		SA, MP, LS	SGRQ	3
Fan et al. [46]	USA	217/209	Hospital	66.0	3	Standardised	11	12	PI	MP, LS	SGRQ	12
Garcia-Aymerich et al. [47]	Spain	68/40	Hospital	72.6	14	Standardised	8	1		PS, SA	SGRQ	12
Khdour et al. [48]	United Kingdom	87/86	Hospital	66.5	56	Heterogeneous	5	12			SGRQ	6, 12
Koff et al. [49]	USA	20/20	Hospital	65.8	53	Heterogeneous	10.6	3		SA	SGRQ	3
McGeoch et al. [50]	New Zealand	73/86	Primary care	70.9	41	Standardised	1	1 day			SGRQ	12
Monninkhof et al. [51]	Netherlands	121/127	Hospital	65.0	16	Standardised	5	4	PI, KL	PS, SA, MP, LS	SGRQ	6, 12
Nguyen et al. [52][a]	USA	41/41/ 43	Not reported	68.7	46	Heterogeneous	35 (arm 1) 29 (arm 2)	12	PI, KL	GS, SA, MP	CRQ	6, 12
Rice et al. [53]	USA	371/372	Hospital	69.9	2	Standardised	13	12	PI	SA	SGRQ	12
Taylor et al. [54]	United Kingdom	38/78	Primary care	69.5	55	Standardised	7	1.75	PI	GS, PS, SA, MP, LS	SGRQ	6
Trappenburg et al. [55]	Netherlands	122/111	Mixed	65.6	42	Standardised	3	4	KL		SGRQ	6
Wakabayashi et al. [56]	Japan	50/52	Primary care	71.7	14	Standardised	6	6		LS	SGRQ	6, 12
Watson et al. [57]	New Zealand	27/29	Primary care	67.5	36	Standardised	1	1 day		SA	SGRQ	6
Wood-Baker et al. [58]	Australia	72/67	Primary care	70.0	42	Heterogeneous	1	1 day		SA, MP	SGRQ	6, 12
Zwar et al. [59]	Australia	217/234	Primary Care	65.1	52	Standardised	9	6		GS, MP	SGRQ	12
Type 2 diabetes mellitus												
Anderson et al. [60]	USA	154/156	Primary care	55.6	59	Standardised	28	24		GS, LS	PAID	24
Beverly et al. [61]	USA	67/68	Hospital	59.2	52	Standardised	4	1	PI	GS	PAID	6, 12

Table 1 (*Continued*)

Study	Country	*N* (control/ SM arms)	Recruitment	Mean age	% female	Training interventionist	Total no. of all contacts	Programme duration (months)	Mode	Content	HRQoL instrument	Time-points (months)
Cheyette et al. [62]	UK	20/29	Hospital	57.2	47	Heterogeneous	8	4	PI, KL	GS, MP, LS	ADDQoL	4
Davies et al. [63]	United Kingdom	387/437	Primary care	59.5	44	Standardised	2	1 day	PI	GS, LS	PAID2	8, 12
Deakin et al. [64]	United Kingdom	157/157	Primary care	61.6	NR	Heterogeneous	6	1.5	PI	GS, PS, MP, LS	ADDQoL	4, 14
Glasgow et al. [65]	USA	417/469	Primary care	62.9	51	Heterogeneous	4	6		GS, PS, LS	PAID2	12
Glasgow et al. [66]	USA	161/174	Primary care	61.5	50	Heterogeneous	3	1.5		GS, PS, SA, LS	DDS	2
Kim et al. [67]	USA	42/41	Community	56.4	45	Standardised	12	6	PI	PS	DQOL	7
Rosal et al. [68]	USA	15/10	Community	62.5	80	Standardised	13	2.5	PI, KL	GS, PS, SA, MP, LS	ADDQoL	6
Shibayama et al. [69]	Japan	67/67	Hospital	61.5	35	Heterogeneous	12	12		GS, PS, MP, LS	PAID2	12
Sigurdardottir et al. [70]	Iceland	28/30	Mixed	60.6	32	Heterogeneous	6	1.5		GS, PS, SA, MP, LS	PAID2	6
Sperl-Hillen et al. [71][a]	USA	134/ 246/243	Primary care	61.8	49	Standardised	3 (arm 1)	3 (arm 1)	PI (arm 2)	GS, PS, MP, LS	PAID	6, 12
							4 (arm 2)	1 (arm 2)				
Whittemore et al. [72]	USA	24/29	Hospital	57.6	100	Heterogeneous	8	6		GS, PS, SA, MP, LS	PAID2	6

ADDQoL = Audit of Diabetes-Dependent Quality of Life; CHQ = Chronic Heart Failure Questionnaire; CRQ = Chronic Respiratory Questionnaire; DDS = Diabetes Distress Scale; DQOL = Diabetes Quality of Life; GS = goal-setting; HRQOL = health-related quality of life; KCCQ = Kansas City Cardiomyopathy Questionnaire; KL = keeping logs; LS = comprehensive lifestyle education; MLWHFQ = Minnesota Living with Heart Failure Questionnaire; MP = management of psychological aspects; NR = not reported; PAID = problem areas in diabetes; PI = peer interaction; PS = problem-solving; QLQ-HF = Quality of Life in Heart Failure Questionnaire; SA = support allocation; SGRQ = St. George Respiratory Questionnaire; SM = self-management.

[a] Unless indicated, multiple intervention arms within one study contained similar programme characteristics.

acute exacerbations or symptoms, resource utilisation), and enhancement of (3) medication adherence, (4) physical activity, (5) dietary intake, and/or (6) smoking cessation.

Studies were included in this meta-regression if they met the following criteria: (1) randomised controlled trial design, (2) conducted in patients with an established diagnosis of CHF, COPD or T2DM, (3) evaluated an intervention which fulfilled the requirements of a self-management intervention as defined above, (4) compared the self-management intervention to usual care, (5) reported data on HRQoL measured with a disease-specific instrument, and (6) reported in English, Dutch, French, German, Italian, Portuguese, or Spanish.

2.4. Data extraction

Data were extracted for source, methods, participants, interventions, and outcomes by one researcher using a standardised format and findings were checked for accuracy by a second researcher. Intervention characteristics to be analysed in the meta-regression were a priori defined based on the self-management literature [2,19,20], social cognitive theory [12], and successful behavioural techniques [9,21]. This led to extraction of the following characteristics: (1) intensity (number of contacts), (2) duration of the intervention (months), (3) training of interventionists (standardised/heterogeneous), (4) peer interaction (yes/no), (5) keeping logs for self-monitoring (yes/no), (6) goal-setting skills (yes/no), (7) problem-solving skills (yes/no), (8) allocation of support (yes/no), (9) management of psychological aspects of living with a chronic condition (yes/no), and (10) comprehensive lifestyle education (yes/no).

The methodological quality of the studies was assessed by two independent researchers through three relevant criteria based on the 'Risk of bias' tool from the Cochrane Collaboration [13]: (1) Concealed random allocation to treatment, (2) intention-to-treat analysis, and (3) other deviances (e.g. discrepancies in baseline characteristics, high drop-out rates, risk of contamination). Discrepancies between the two researchers were solved through discussion with a third researcher.

2.5. Statistical analysis

The outcome of interest was disease-specific HRQoL. Disease-specific instruments are considered important primary endpoints in randomised controlled trials due to their clinically detailed measurement of patients concerns and their potential responsiveness to change [17]. To distinguish between short term and long term effects on HRQoL, comparisons in studies were divided in two groups: comparisons measuring HRQoL around 6 months follow-up (range 2–8 months) and comparisons measuring HRQoL around 12 months follow-up (range 12–24 months).

For each comparison the standardised mean difference (SMD) with 95% confidence interval (CI) was estimated as a measure of treatment effect. SMDs are uniform measures used to pool results of studies measuring the outcome differently [13]. A positive SMD indicated an increase in HRQoL at follow-up in the intervention group compared to the control group. Data were explored graphically through forest plots using the software package Comprehensive Meta-Analysis (version 2.0; Biostat Inc., Englewood, NJ). Heterogeneity was formally assessed using the I^2 statistic [13]. Statistical tests in meta-analyses often suffer from

insufficient power, hence it is recommended not to rely on statistics alone when exploring heterogeneity across studies [22].

Weighted random effects linear regression models were fitted to identify which intervention characteristics were associated with improvements in HRQoL. Random effects models allow for residual heterogeneity beyond chance once covariates have been fitted and are therefore considered the appropriate analysis for meta-regressions [23]. To allow for a meaningful contrast in the analyses, we included only those intervention characteristics in the analyses if the contrast was based on a minimum of 2 studies with data at both time points for each chronic condition. This resulted in the analyses being restricted to (1) intensity, (2) duration of the intervention, (3) training of interventionists, (4) peer interaction, (5) problem-solving skills, (6) management of psychological aspects.

For both time points (around 6 months and 12 months), separate analyses were conducted for each intervention characteristic. Chronic condition and mean age of participants in each trial were included as covariates in the models to adjust the effect sizes. Due to the low number of studies included at each time point it was decided to refrain from models including multiple intervention characteristics as these might be overfitted [23]. Interactions between intervention components and conditions were assessed using an F-test: in case of interaction ($p < 0.05$), results were not pooled across conditions. Analyses were repeated for each chronic condition separately to assess if the effectiveness of intervention components differed in the separate conditions. All regression analyses were performed in R for Windows version 2.15.3 (R Development Core Team, Released 2013, Vienna, Austria: R Foundation for Statistical Computing).

Sensitivity analyses were performed excluding those studies that were deemed as high risk of bias based on the quality appraisal. To assess whether it was suitable to combine different HRQoL instruments in the analysis, separate regression models were fitted with the instrument as a covariate [24]. Publication bias was assessed by generating a funnel plot and evaluating asymmetry [25].

3. Results

Our search identified 7878 potentially eligible publications, which were screened on title/abstract (Fig. 1). Seventy-nine trials met our inclusion criteria and were selected for data extraction. In 32 publications the outcome for HRQoL was reported in such a way that it could not be pooled in a meta-regression, which led to the exclusion of those trials. This resulted in a selection of 47 trials for this meta-regression [26–72], representing a total of 10,596 patients. Details of the selected trials, including the extracted intervention components for the meta-regression are summarised in Table 1.

The characteristics of the different interventions are presented in Figs. 2 and 3. These show that individual face-to-face contacts were the most often applied mode in trials for COPD (86%) and T2DM patients (57%), whereas logs for monitoring symptoms were most frequently used in interventions for CHF patients (75%). For CHF, nearly all interventions addressed medication management or self-monitoring of symptoms (both 94%). For COPD interventions, action plans (90%) were most frequently used next to medication management (100%). Interventions for T2DM patients focused mainly on goal-setting skills (93%) and lifestyle change through exercise or nutrition (86%). The pattern in Fig. 3 shows great diversity in duration and intensity across trials, also within a specific condition.

Summary statistics showed beneficial effects of self-management interventions compared to usual care on HRQoL, with (SMD = 0.20, 95% CI: 0.13–0.26) at 6 months and at 12 months

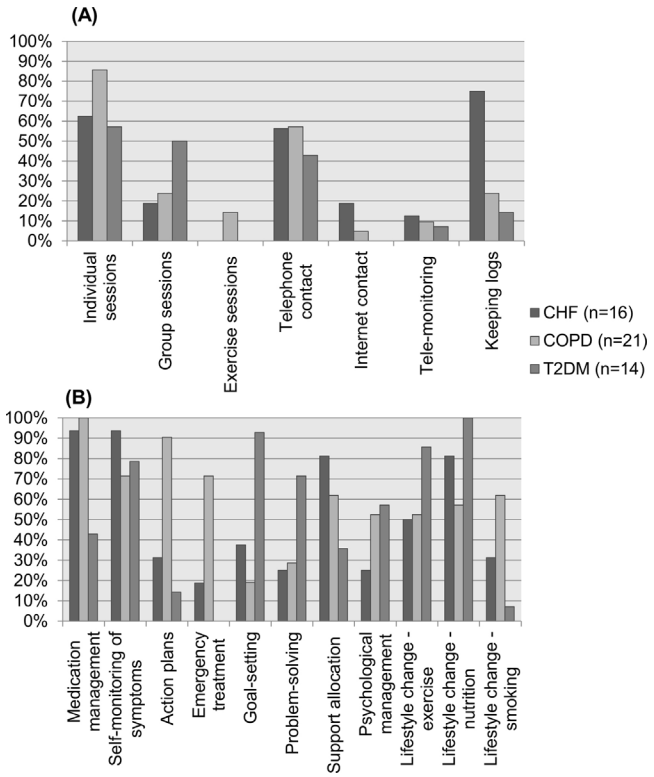

Fig. 2. Diversity in mode (A) and content (B) of self-management interventions for chronically ill patients.
CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; T2DM = type 2 diabetes mellitus.

(SMD = 0.13, 95% CI: 0.07–0.19), see Fig. 4 for forest plots. Heterogeneity was moderate with I^2 statistic of 35% at 6 months and 48% at 12 months. For the three separate chronic conditions, self-management interventions also showed positive effects on HRQoL at 6 months for CHF (SMD = 0.34, 95% CI: 0.19–0.48), for COPD (SMD = 0.21, 95% CI: 0.10–0.32), and for T2DM patients (SMD = 0.11, 95% CI: 0.01–0.22). Twelve months effects of self-management on HRQoL were also positive for each chronic condition, with effect sizes of 0.29 (95% CI: 0.13–0.45), 0.12 (95% CI: 0.03–0.21) and 0.08 (95% CI: −0.02 to 0.18) for respectively CHF, COPD, and T2DM patients.

The results of the meta-regression analysis are presented in Tables 2 and 3. The analysis of the combined data on the three chronic conditions showed a negative association for standardised training of interventionists (SMD = −0.16, 95% CI: −0.31 to 0.01) and peer interaction (SMD = −0.23, 95% CI: −0.39 to 0.06) with HRQoL at 6 months follow-up. The analysis for the separate chronic conditions showed a positive association with HRQoL at 6 months follow-up for duration (SMD = 0.07, 95% CI: 0.01–0.14) and teaching problem-solving skills (SMD = 0.27, 95% CI: 0.02–0.51) in T2DM patients, whereas interaction with peers was negatively associated with HRQoL at 6 months follow-up (SMD = −0.25, 95% CI: −0.48 to 0.02) in those patients. No associations were found for any intervention component in the CHF and COPD studies. Sensitivity analyses excluding studies with a high risk of bias [29,30,40,43,45,49,50,56–60,62,68,72] did not alter the significant negative associations found for standardised training and peer interaction with HRQoL at 6 months follow-up, but also showed a positive association for intensity of interventions with HRQoL at 6 months (see Appendix Table A.2 and A.3 in Supplementary material for more detail).

Using the type of HRQoL instrument as a covariate in the regression analyses to assess the impact of pooling different

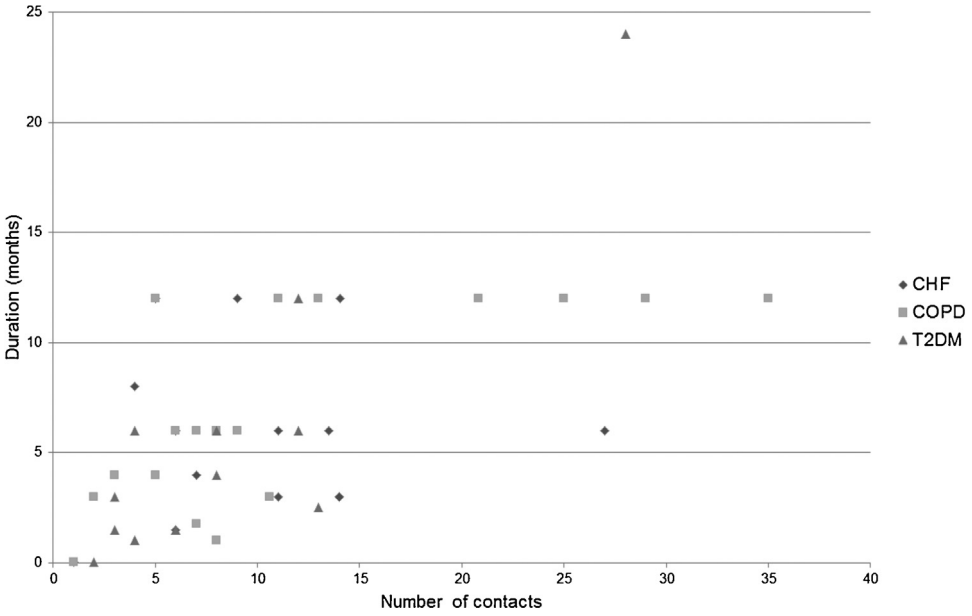

Fig. 3. Diversity in duration and number of contacts of self-management interventions for chronically ill patients.
CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; T2DM = type 2 diabetes mellitus.

instruments showed no association. The funnel plot for publication bias showed a tendency towards publication of more positive trials (see Appendix Fig. A.1 in Supplementary material).

4. Discussion and conclusion

4.1. Discussion

The present study revealed that self-management interventions show great diversity in terms of mode, content, intensity, and duration. In spite of this diversity, self-management interventions exerted moderate positive effects on HRQoL at 6 months (SMD = 0.20, 95% CI: 0.13–0.26) and at 12 months follow-up (SMD = 0.13, 95% CI: 0.07–0.19) in patients with CHF, COPD, or T2DM. The analyses for the three conditions separately yielded similar positive effects. These findings are consistent with the results of previously conducted systematic reviews on each of the chronic conditions separately [5–8].

In this study, we approached self-management support as a complex intervention and used meta-regression techniques in an attempt to untangle the effective components. Although we analysed six different components of self-management interventions, the meta-regression analysis showed counterintuitive negative associations for structured training of the interventionist and peer interaction with HRQoL at 6 months. No components were identified that favourably affected HRQoL. Behavioural interventions are generally not considered to be harmful, therefore we expected any association observed in our analysis to improve instead of reduce HRQoL. Previous meta-regression analyses on self-management indeed did not observe any negative associations [15,16], but the only component to show a significant positive impact on the outcome was face-to-face contact [16]. However, the main difference between these studies and our study is the outcome chosen: the earlier meta-regressions evaluated physical parameters instead of HRQoL.

Although the importance of training for interventionists in complex interventions and benefits of interaction with peer patients on the uptake of self-management behaviours have been emphasised [12], the present study suggests that those factors impede improvement in HRQoL at 6 months. These findings seem to contradict the assumption that interventions involving educated peer patients are more effective than those involving health care professionals only. A possible explanation for our findings can be sought in a so-called 'response shift' in HRQoL. Over time, patients may develop a new notion of how they appraise their HRQoL, for example due to worsening of their condition or re-evaluation of norms in life. This response shift may result in different appraisal of items on a HRQoL instrument at follow-up and complicates the interpretation of change scores in HRQoL [73]. One could argue that contact and comparison with peer patients (whose HRQoL may be relatively good) might have altered patients' perceptions of how they appraise their own HRQoL, resulting in lower scores compared to patients in studies who were not exposed to peers in the self-management arm. The negative association found for structured training of interventionists questions current attention for comprehensive training of interventionists. Another study on care interventions in seriously ill patients provided by specifically trained professionals found more signs of depression in the intervention group compared to those receiving usual care. The authors could not explain this finding either [74].

Yet, we can question to what extent a response shift in HRQoL can be accountable for the effects found. The self-management interventions studied in this meta-regression were complex interventions consisting of multiple components. The limited number of available studies unfortunately prevented us from analysing combinations of intervention components, a problem more often encountered in meta-regressions [23]. A univariable meta-regression analysis of intervention components might disregard the complexity of self-management interventions, since different intervention components may interact with one another [75]. We checked for other commonalities (in terms of year publication, region, methodological quality, patients' baseline characteristics, other intervention components) in the subgroups of interventions with either standardised training or peer interaction, but could not observe any. However, there is the possibility that these subgroups of interventions had another aspect in common that had a negative impact on HRQoL which was not extracted but might explain the counterintuitive associations found for standardised training and peer interaction.

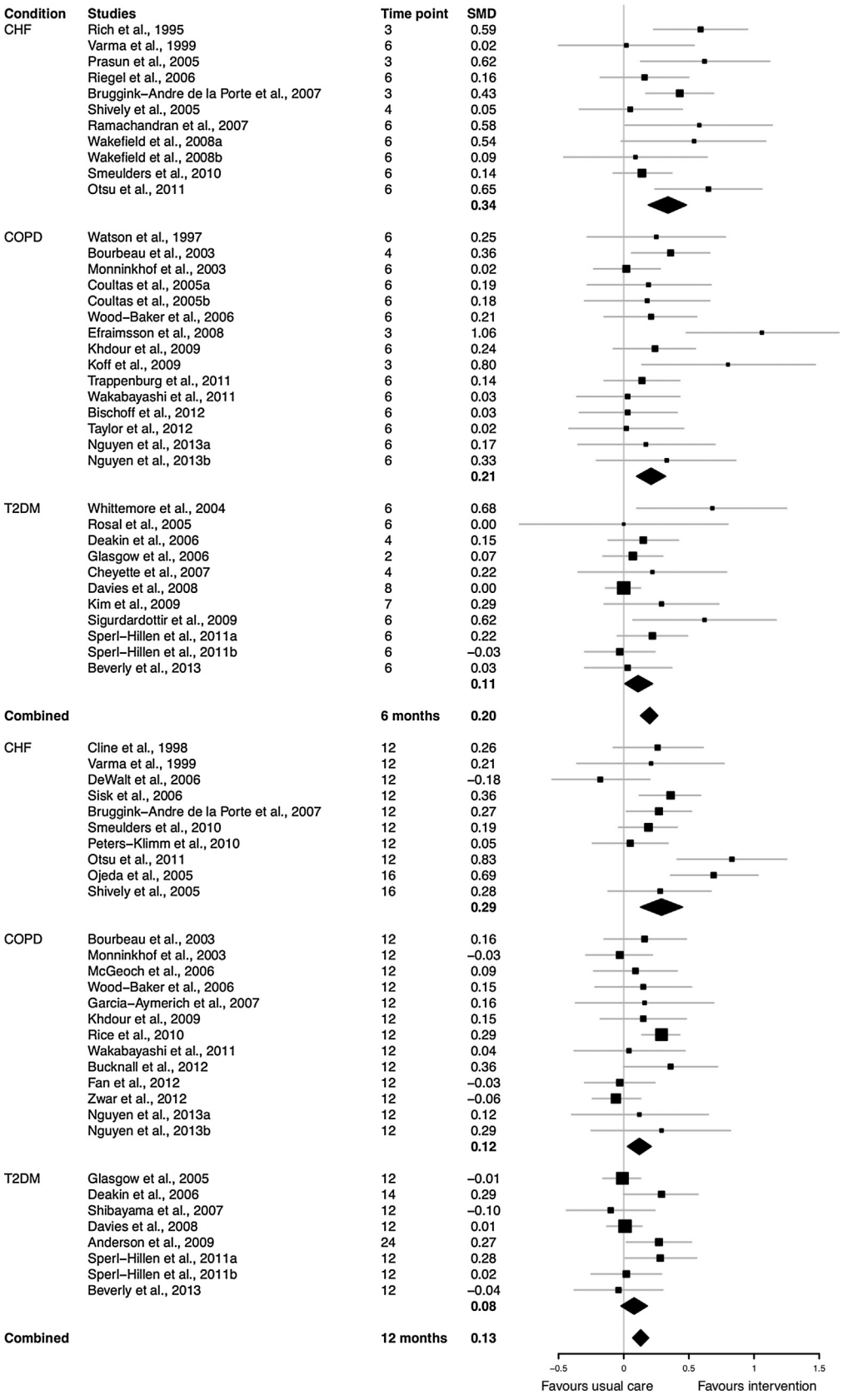

Fig. 4. Forest plot of effects of self-management interventions vs. usual care on health-related quality of life.
CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; SMD = standardised mean difference; T2DM = type 2 diabetes mellitus.

Table 2
Effects of components of self-management interventions on health-related quality of life for patients with chronic heart failure, chronic obstructive pulmonary disease, or type 2 diabetes mellitus.

Components of the intervention	6 months ($N = 37$)	12 months ($N = 31$)
1. Intensity (# contacts)	0.01 (−0.01 to 0.02)	–[b]
2. Duration (months)[a]	0.02 (−0.03 to 0.06)	0.01 (0.00 to 0.02)
3. Training interventionist (y/n)	−0.16 (−0.31 to −0.01)	0.03 (−0.14 to 0.19)
4. Peer interaction (y/n)	−0.23 (−0.39 to −0.06)	−0.02 (−0.18 to 0.13)
5. Problem-solving (y/n)	−0.07 (−0.24 to 0.09)	−0.10 (−0.25 to 0.05)
6. Psychological aspects (y/n)	0.10 (−0.05 to 0.25)	0.02 (−0.13 to 0.16)

Numbers are regression coefficients adjusted for mean age of participants per study and chronic condition (with 95% confidence intervals), representing change in standardised health-related quality of life when the intervention component was present.
[a] For analysis of duration at 6 months $N = 31$: programmes lasting longer than the time point were excluded from the analysis.
[b] Interaction term with condition indicated too much heterogeneity to combine conditions.

Table 3
Effect of components of self-management interventions on health-related quality of life for chronically ill patients.

Components of the intervention	CHF		COPD		T2DM	
	6 months ($N = 11$)	12 months ($N = 10$)	6 months ($N = 15$)	12 months ($N = 13$)	6 months ($N = 11$)	12 months ($N = 8$)
1. Intensity (# contacts)	0.01 (−0.03 to 0.05)	−0.05 (−0.11 to 0.01)	0.00 (−0.01 to 0.02)	0.01 (0.00 to 0.01)	0.03 (−0.02 to 0.08)	0.01 (−0.02 to 0.03)
2. Duration (months)[a]	0.01 (−0.11 to 0.13)	0.00 (−0.06 to 0.07)	−0.03 (−0.13 to 0.07)	0.02 (0.00 to 0.03)	0.07 (0.01 to 0.14)	0.00 (−0.02 to 0.03)
3. Training interventionist (y/n)	−0.20 (−0.54 to 0.14)	0.07 (−0.41 to 0.55)	−0.11 (−0.42 to 0.20)	−0.05 (−0.24 to 0.14)	−0.17 (−0.42 to 0.07)	0.00 (−0.40 to 0.39)
4. Peer interaction (y/n)	−0.33 (-0.77 to 0.01)	−0.08 (−0.64 to 0.48)	−0.16 (−0.45 to 0.14)	0.07 (−0.07 to 0.20)	−0.25 (−0.48 to −0.02)	−0.06 (−0.35 to 0.25)
5. Problem-solving (y/n)	−0.26 (−0.62 to 0.11)	−0.37 (−0.74 to 0.01)	−0.15 (−0.43 to 0.14)	0.02 (−0.15 to 0.19)	0.27 (0.02 to 0.51)	0.29 (−0.17 to 0.75)
6. Psychological aspects (y/n)	0.15 (−0.22 to 0.53)	0.11 (−0.38 to 0.61)	0.00 (−0.28 to 0.29)	−0.03 (−0.22 to 0.15)	0.22 (−0.02 to 0.45)	0.15 (−0.14 to 0.44)

Numbers are regression coefficients adjusted for mean age of participants per study (with 95% confidence intervals), representing change in standardised health-related quality of life when the intervention component was present.
CHF = chronic heart failure; COPD = chronic obstructive pulmonary disease; T2DM = type 2 diabetes mellitus.
[a] For analysis of duration at 6 months $N = 9$ for CHF and $N = 11$ for COPD: programmes lasting longer than the time point were excluded from the analysis.

The negative association found for peer interaction remained significant in the separate analyses for T2DM patients, whereas there was no indication for such an association in CHF and COPD patients. Teaching patients problem-solving skills and duration of the intervention were components found to be positively associated with HRQoL in T2DM patients. These findings are not supported by earlier meta-regressions in T2DM patients, but a comparison is troublesome since previous meta-regressions focused on glycaemic control and other physiological outcomes instead of HRQoL [76–78]. The mechanism behind improvements in a psychosocial outcome such as HRQoL might differ from physiological outcomes, as a previous systematic review pointed out [79]. The authors found that problem-solving techniques in diabetes self-management education elicited overall more positive effects in psychosocial outcomes (including HRQoL) than in physiological outcomes. The present findings support this, but more research is needed to understand how different intervention techniques affect different outcomes.

Although this meta-regression was performed with great care, this study has several limitations in addition to the ones mentioned. First, the funnel plot showed a tendency towards publication bias in favour of studies with positive results. Our positive main effects of self-management interventions on HRQoL should therefore be interpreted with some caution. Second, we pooled different instruments for measuring HRQoL, which could introduce heterogeneity in study results due to differences in responsiveness on instruments [24]. We tested for association between effect sizes and the instruments by including the type of instrument as a covariate in the regression models, for which we found no significant association. Third, the extraction of intervention components and outcomes depended on the quality of reporting of studies. Previous research has shown that reporting details of complex interventions is compromised in the majority of studies [80], a problem also experienced by authors of other meta-regressions [15,16]. Lack of intervention details seriously impairs our understanding of what exactly patients have been exposed to [80]. Thoroughly conducted and reported process evaluations of complex interventions, exploring the implementation of interventions and uptake by patients through mixed methods, are an essential step in investigating effective components of multifaceted interventions[9]. Finally, due to little contrast between studies, particularly amongst the T2DM studies, several of the a priori defined intervention characteristics could not be analysed, which leaves us oblivious as to whether these clinically relevant characteristics may be instrumental in the success of complex interventions.

A drawback of the meta-regression approach is the reliance on aggregate data of studies. Individual patients may respond very differently to components of self-management interventions, yet we lack knowledge on which patient factors exactly influence this process. To enhance our understanding of the effectiveness of self-management interventions individual patient data (IPD) meta-analyses may be useful; these allow for an analysis combining data at the level of individual patients from multiple studies with the aim to identify in which patients which interventions elicit the largest effect.

4.2. Conclusion

This meta-regression suggests that in spite of the large diversity in interventions evaluated, self-management interventions may improve HRQoL at 6 months and 12 months. We could not identify

any intervention components that are favourably associated with improvement in HRQOL across chronic conditions. Providing structured training to interventionists and interaction with peers seem to hamper improvement in HRQoL, but further research is needed to understand the underlying mechanisms since co-occurrence of unobserved study characteristics might explain these findings.

4.3. Practice implications

Chronically ill patients with CHF, COPD, or T2DM can benefit from self-management interventions in terms of improvements in their HRQoL at 6 and 12 months, but effects on HRQoL beyond 12 months still need to be established. Thoroughly conducted and reported process evaluations of self-management interventions are an essential step in comparing components of multifaceted interventions and understanding which components are essential for eliciting effects. Through studying self-management interventions on the patient level rather than the aggregate study level, IPD meta-analyses may help to generate valuable insights into which subgroups of patients respond to which components of these interventions.

Conflict of interest

None.

Authors contributions

Jonkman had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design

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Acquisition of data

Jonkman, Trappenburg.

Analysis and interpretation of data

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All authors read and approved the final manuscript.

Role of funding

This study was supported by a grant from the Dutch Ministry of Health, Welfare and Sports, ZonMw (grant number 520001002). The funding source had no involvement in the design and conduct of the study; collection, analysis, and interpretation of the data; in the writing of the report; and in the decision to submit the article for publication.

Acknowledgements

The authors thank Irene Bos-Touwen and Heleen Westland from University Medical Center Utrecht for their contribution to the design of this study and Esther van de Beek, from University Medical Center Utrecht, and Jasper Machiels, from Christian-Albrechts University Kiel, Germany, for their support in the data extraction. This study was supported by a grant from the Dutch Ministry of Health, Welfare and Sports, ZonMw (grant number 520001002).

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.pec.2016.01.022.

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