Educational interventions to improve outcomes in patients with atrial fibrillation

a systematic review

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Educational interventions to improve outcomes in patients with atrial fibrillation – a systematic review

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Abstract

Background: Atrial fibrillation (AF) is an emerging epidemic associated with poor mental health and quality of life, as well as morbidity and mortality. Whilst other cardiovascular conditions have demonstrated positive outcomes from educational programmes, this approach is not well integrated in clinical practice in patients with AF. Though evidence in this area is mounting, a thorough overview seems to be lacking.

Aim: To assess benefits and harms of educational interventions compared with no intervention in adults with AF.

Method: A systematic review and meta-analysis were performed including the outcomes: Serious adverse events (mortality and readmission), mental health (anxiety and depression), physical capacity, quality of life and self-reported incidence of symptoms of AF. PubMed, Embase, Cinahl, Cochrane Library and PsycINFO were searched between June and august 2018. Data extraction and quality assessment were performed independently by two reviewers. The Cochrane Risk of Bias tool was applied for the randomised controlled trials and the Amstar Checklist for the systematic reviews.

Results: Eight randomised controlled trials and one non-randomised interventional study were included, with a total of 2388 patients. Comparing with controls patient education was associated with a reduction in: Serious adverse events (Risk Ratio 0.78, CI 95% 0.63-0.97), anxiety with a mean difference of -0.62 (CI 95% -1.21, -0.04), and depression with a mean difference of -0.74 (CI 95% -1.34, -0.14). Health-related quality of life and physical capacity was found to increase after patient education, yet only one study found statistically significant differences between groups. No differences were observed with regards to self-reported incidence of symptoms of AF.

Conclusions: Educational interventions significantly decrease the number of serious adverse events in patients with AF and seem to have a positive impact on mental health and self-reported quality of life. However, the evidence is limited, and more studies are warranted.

Keywords: Atrial Fibrillation, Educational Interventions, Review, Quality of Life, Mental Health, Serious Adverse Events.

How did you gather the information you considered in your review?

- A systematic review was performed.
- Two authors selected, extracted and bias assessed the included trials.
- Meta-analyses were performed.

What is the 'take-home' message for the clinician?

- It is recommended to include education for patients with AF.
- The education should include: life with AF, symptoms to respond to, knowledge about illness and treatment, and psychological reactions.

Background

AF is the most common arrythmia and worldwide nearly five million people are diagnosed annually (1,2). The prevalence of AF is increasing as the population ages globally, and is predicted to affect 6–12 million people in the USA by 2050 and 17.9 million in Europe by 2060 (3,4). For patients with AF, increased mortality rates, high stroke event rates, and heart failure are observed (2). Treatment focuses on reducing or eliminating symptoms of AF, and on improving quality of life (2). Symptoms of AF include heart palpitations, light-headedness, dyspnoea, fatigue and dizziness (2).

Patients living with AF describe struggling with continuously trying to understand their symptoms, feeling emotionally distressed and feeling uninformed and unsupported by health care professionals (5). It has also been found that patients often are unaware of the necessary precautions they need to take in everyday life because of the disease, like stroke prevention and patients lack knowledge about treatment options and effects for AF (6). Furthermore, many patients with AF experience decreased physical capacity (7) and lower quality of life compared to the general population but also compared to patients with e.g. ischemic heart disease (8,9), some patients also report of high levels of anxiety and depression (10).

Cardiac rehabilitation is considered a class one recommendation for patients with ischemic heart disease and heart failure (11,12). Patient education is considered a core part of cardiac rehabilitation with the intention of providing patients with health information so they improve their health status (13). To improve or support patient's mental status, psycho-social support is often provided together with education (14).

Now patient education is recommended in the European Guidelines for patients with AF based on few identified interventional studies (2). The purpose of this present review was to identify studies testing educational interventions and assess and synthesise the evidence of these.

Aim

To assess the effectiveness and benefits and harms of educational interventions compared with no intervention in adults with AF.

Methods

This publication is conducted in collaboration with the Danish Health Authority and is based on the work performed in relation to developing the Danish National Clinical Guideline entitled: *National Clinical Guideline for Rehabilitation for Patients with Atrial Fibrillation, Atrial Flutter, Patients with Endocarditis and Patients treated with an Implantable Cardioverter Defibrillator (ICD)* published in Danish (15).

Search strategy

A literature search for systematic reviews and primary literature published between 2008-2018 was conducted in the following resources and databases: PubMed, Embase, Cinahl, Cochrane Library and PsycINFO. Studies written in English, Danish, Swedish and Norwegian was included. A mix of MeSH and free text terms related to the key concepts of this review were used in the searches.

The literature search was performed by a research librarian in collaboration with SSR between June and August 2018 (see example of search in Supplementary File 1).

All references were assessed for eligibility by two independent reviewers (PP and IQ) using the inclusion criteria.

Study type and participants

Systematic reviews and randomised controlled trials (RCTs) of educational interventions in adults with verified AF (paroxysmal, persistent or permanent) and/or atrial flutter.

Types of intervention

Studies were included if they comprised an educational programme defined as a programme with the intent of improving the patient's knowledge of illness, symptoms and treatment, and/or providing psychosocial support. The patient education could include information on the onset and development of the disease, modification of risk factors and health behaviour, treatment, action plans, symptom management, adherence to treatment and prevention and psychosocial reactions. The educational programme could be delivered individually, or group based.

This was compared to usual practice that did not include participation in an educational intervention.

Outcomes

Outcomes were: Serious adverse events (death and readmission), self-reported incidence of symptoms of AF, health-related quality of life, anxiety, depression, physical capacity after intervention ended and/or at longest follow-up time reported e.g. at 12 months.

Two reviewers (PP and IQ) performed the data extraction independently in a matrix to get an overview over extracted data.

Data synthesis

Where results were poolable statistical analyses were performed using RevMan 5.3. For continuous outcomes individual meta-analyses were completed by using the mean value and standard deviation (SD) between groups (intervention and control) at the end of the intervention and at the time of longest follow-up. For continuous outcomes, mean differences were used, as data were homogeneous. For binary data, risk ratios (RRs) were calculated. Statistical heterogeneity was quantified using the I^2 test with values ranged from 0% (homogeneity) to 100% (high degree of heterogeneity) (16). Heterogeneity decided if random or fixed effect models were applied. We presented results from the random-effects model when heterogeneity was high and from fixed-effects when heterogeneity was low. Statistical significance was judged based on a level of significance of 5%, with 95% confidence intervals (CI).

Risk of bias

The quality of the studies was evaluated by the Amstar for the systematic reviews (17) and Cochrane Risk of Bias tool (16) for the RCTs. Two reviewers (PP and IQ) performed the risk of bias assessment independently. Disagreements were resolved by discussion. Quality assessment included component ratings for randomisation, allocation, blinding, incomplete outcome data, selective reporting and other bias, and resulted in a global rating for the reference being either low, high or unclear quality. One non-randomized interventional study included in the systematic review was assessed by the The Risk Of Bias In Non-randomized Studies – of Interventions (ROBINS-I) assessment tool, version 1, 2016 independently by two reviewers (PP and SSR) (18).

Results

Results of the systematic literature search

For the systematic literature search our search yielded a total of 1074 titles (962 after removal of duplicates). After reviewing titles and abstracts, 50 full-text references were potentially eligible for inclusion. After examining the full-text references, nine references (two systematic reviews and eight

RCTs) were included for data extraction and analysis (19–27). The selection process is summarised in the flow chart shown in Figure 1.

Altogether, there were three randomised controlled trials (23–25) and one non-randomised interventional study (28) included from the two included systematic reviews focusing on the same outcomes as explored in this review.

Overall results of literature search

Altogether we included nine original trials of which eight were RCTs (19–25,29) and one was a non-randomised interventional study (28). Three trials were identified both in the systematic reviews and the RCT search (23–25).

Trial and participants characteristics

A total of 2368 patients were included in the trials. All nine trials included patients with AF (19–25,28,29). The mean age in the intervention group ranged from 58 years to 74.8 years and the control group from 59 years to 77.3 years. In eight of the trials the majority of the participants were males (52.0%-71.5%) (20–25,28,29). Only in the study by Fuenzalida et al. did females represent the majority (57.5%) (19). The detailed information on the included studies can be found in the characteristics of included studies in Table 3.

Description of interventions

The interventions used in the trials differed. In the trial by Clarkesmith et al. the intervention aimed at increasing time within therapeutic (INR) range and the intervention consisted of a group-based session including 'expert-patient' DVD, educational booklet, self-monitoring diary and worksheet (23). The trial by Fuenzalida et al. aimed to decrease AF-related or treatment-related complications and registered death. The intervention consisted of education at discharge including information about AF, pulse taking and an information leaflet (19). Guo et al. aimed at increasing patients' knowledge about AF using a smartphone application including education about AF and structured follow-up components (20). Hendriks et al. introduced an intervention consisting of a nurse-led AF clinic where focus was on individualised psychosocial support and AF education, the aim of the intervention was to decrease hospitalization and death (24). Malm et al. aimed at improving health related quality of life by introducing dyadic cognitive behavioural therapy three sessions of 2.5 hours each (21). Risom et al. introduced a comprehensive cardiac rehabilitation programme consisting of physical exercise and psycho-educational interventions with the primary aim at increasing physical capacity (30). The trial by Stewart et al. aimed at increasing event-free

survival and decreasing death and hospitalisation by using home visits by a nurse 7-14 days post discharge and with follow-up (25). Carter et al. aimed at decreasing hospitalisation and emergency department visits introducing an integrated management approach with nurse based, physician-supervised care for patients with new-onset AF (28). The trial by Bowyer et al. tested an educational intervention on symptom severity and health related quality of life (29).

The duration of the interventions was between 6 and 24 months (19–25,29) (see Table 3).

Outcomes

Serious adverse events (death and readmission)

The assessment of serious adverse events included five RCTs (19,22–25) and one non-randomised interventional study (28) including in total 2007 patients. The meta-analysis showed a difference between groups with a lower number of patients experiencing serious adverse events in the intervention group compared with control (Risk Ratio 0.78, CI 95% 0.63-0-97) (Figure 2).

Self-reported incidence of symptoms of AF

A study with 210 participants (22) examined the difference of AF symptoms using self-reported incidence of symptoms of AF after six months. Equal numbers (n=3) in the intervention and control group experienced arrhythmia.

Health-related Quality of Life after intervention

Results from one study including 712 patients (31) found a positive effect of patient education on health-related quality of life (measured with Short Form 36 Questionnaire (SF-36)) within groups but not between groups. After one year, significant improvements were seen in the following health-related quality of life subscales: Role Emotionel (P =0.004), Mental Health (P= 0.001), and Vitality (P = 0.008) in the intervention group. The latter two, however, also significantly improved in the usual care group (Mental Health P = 0.002, Vitality P<0.001), as well as Role Physical (P = 0.004) (31).

A study with 209 patients (20) showed a positive effect between groups of patient education on health-related quality of life measured by the EuroQol (intervention group mean 87.6 vs 70.1 in the control group, P<0.05), which was still present after three months (20). One study showed no difference between groups on health-related quality of life (22).

A study with 41 patients found a positive effect between groups on two of the eight SF-36 subscales, physical function, (intervention mean 88.58 vs 70.78 in the control group, p=0.002), and vitality, (intervention group 70.86 vs 54.31 in the control group, p=0.005). No differences were seen on the other subscales and the overall score not reported (29).

Anxiety:

Anxiety after intervention

One study including 78 patients (21) found no difference between groups on anxiety measured by the Hospital Anxiety and Depression Scale – Anxiety (HADS-A) (lower score indicates less anxiety symptoms) at end of intervention (after 12 months), (intervention group mean 5.76 vs 4.85 in the control group, P=0.40). The study by Guo et al. with 209 patients (20) examined the effect of patient education on anxiety and depression by using the EuroQol (EQ-5D-Y). Results showed that anxiety and depression were improved in the intervention group over time (all p<.05).

Another study including 210 patients showed no difference between groups on anxiety measured on HADS-A after intervention six months after recruitment (intervention group mean 3.85 vs 3.80 in the control group, p=0.09) (22).

Anxiety longest follow-up

Two studies (23,24) including 587 patients showed a difference between groups in favour of patient education on anxiety with a mean difference of -0.62 (CI95% -1.21, -0.04) at 12 months (23,24) (Figure 3).

At 24 months follow-up results of Risom et al. showed a difference between groups in favour of the intervention group where scores of HADS-A ≥8 were 3.92 (12.8%) vs 4.73 (23.8%) in the control group (P<0.05) (32).

Depression:

Depression after intervention

One study from 2018 including 78 patients (21) found no effect of patient education on depression measured by the Hospital Anxiety and Depression Scale – Depression (HADS-D) (lower score indicates less depressive symptoms) at end of intervention, (intervention group mean 4.16 vs 3.15 in the control, P= 0.4).

Another study with 209 participants (20) examined the effect of patient education on depression. Differences between the groups were seen at baseline for mild depression (P=0.014) but the differences were balanced at three months follow-up (P=0.36).

Another study including 210 patients showed no difference between groups on depression measured on HADS-D after intervention six months after recruitment (intervention group mean 2.92 vs 2.36 in the control group p=0.41) (22).

Depression longest follow-up

The meta-analysis based on two studies (23,24) including 587 patients showed an effect in favour of patient education on depression with a mean difference on -0.74 (CI 95% -1.34, -0.14) (Figure 4).

At 24 months follow-up the results of Risom et al. showed no difference between groups where scores of HADS-D ≥8 were 2.57 in the intervention group vs 2.86 in the control group. In the intervention group 6.4% of the patients scored ≥8 vs 6.3% in the control group (32).

Physical capacity:

Physical capacity after intervention

Based on result from 157 patients from the study by Risom et al. (22) including both patient education and physical training, results showed an effect in favour of the intervention compared to control on physical capacity measured by VO_2 peak (Intervention groups: mean 24.3(ml/kg/min) vs control group: mean 20.7 (ml/kg/min), p=0.02). Furthermore, data on 149 patients from the same study showed an effect in favour of the intervention on the 6-minute walk test (6MWT) with a mean difference between groups of 14 meters (p of interaction between time and intervention was 0.02). The physical training consisted of: Graduated cardiovascular training based on intensity prescription and strength exercises altered stepwise during training sessions. Training intensity was progressively increased during the 12 weeks the intervention lasted (22).

Physical capacity longest follow-up

At 12-months follow-up results from the trial by Risom et al. showed a difference between groups in favour of the intervention group when measuring physical capacity by VO_2 peak (Intervention groups: mean 25.8 (ml/kg/min) vs control group: mean 22.4 (ml/kg/min), p=0.002) (22).

Risk of bias

Systematic reviews: The quality of the two systematic reviews was overall evaluated as high on Amstar (Table 1).

Randomised Controlled Trials: The quality of the eight RCTs was evaluated with the Cochrane Risk of Bias tool (33) and demonstrated various risks of bias across the domains. In the domain "Blinding of participants and personnel" all trials were judged as "unclear risk" or "high risk" where in the domain "Sequence generation" and "Allocation concealment" most trials were judged as "low risk" (Table 2a).

Non-randomised studies: The quality of the non-randomised study was assessed with the Risk Of Bias In Non-randomized Studies – of Interventions (ROBINS-I) assessment tool and found to include an overall low risk of bias (Table 2b) (18).

Discussion

Overall, our review and meta-analysis of educational intervention targeted at patients with AF revealed positive effects including a significant reduction in the number of serious adverse events, including mortality and readmission. Health related quality of life improved both within and between groups and, in some cases, persisted over time. Anxiety improved after long follow-up time, but no effect was seen in close relation to the interventions. The same trend was seen with regards to depression. Physical capacity increased after participation in an intervention consisting of both education and physical exercise training and this was sustained at 12 months follow-up.

A possible reduction in the number of serious adverse events is evidently important to the patient, as well as to the clinicians and society. Strong evidence for effects of education for patients with AF on this important outcome provides clinicians with a strong argument for prioritising, planning and allocating resources to this element at the same level as other care or treatment. In the Western world AF is found in approximately 3% of the population and the prevalence is increasing (2). The number of patients with AF experiencing hospitalisation is substantial, making AF a considerable economic burden for society (2). Preventing hospitalisations or even premature death via educational programmes for patients with AF may not only alleviate human suffering but also reduce health care costs.

For anxiety we found no difference between groups after the end of intervention, but at longest follow-up three trials showed a significant difference in favour of the intervention groups. It is documented that patients with AF experience high levels of anxiety even after ablation treatment, where around 70% of patients should be free of AF symptoms after the ablation treatment (2,34,35). The results from this review indicate that participating in an intervention including an educational component can lower anxiety levels for patients up to 24 months after inclusion in an intervention. Qualitative findings support this finding, as patients having participated in an intervention including education confirmed that they needed support from healthcare-professionals to move on (36). One previously mentioned qualitative study evaluated participating in a rehabilitation programme for patients with AF including a psycho-educational component (36). Patients described that the psycho-education (delivered either face-to-face or by telephone) was important to them as they still needed support to move on and health-professionals helped them regaining confidence in their mental strength (36). However, it does not fully explain why no difference between groups were found at the end of intervention. The interviews were conducted right after ending the intervention and it may be that the patients at this point still needed support to move on and that they still

had to integrate the learned coping skills into their life without support of health-professionals. In the European Guidelines education is recommended with the goal of increasing the patient's feeling of being informed, involved, and empowered (2). The results of our review support and underline the importance of this recommendation with added evidence of decreased adverse events in favour of educational programmes compared to 2016 when the guidelines were developed and published (2).

Comparing the results of this review to the results of other reviews conducted in patient with AF where educational components have been used, mixed results are found. In the Cochrane review by Clarkesmith and colleagues the evidence concerning educational and behavioural interventions for anticoagulant therapy (measured by time in therapeutic range of anticoagulation therapy) in patients with AF was gathered (27). Based on 2246 patients they concluded that there was insufficient evidence to draw definitive conclusions regarding what impact educational or behavioural interventions had on patients' time in therapeutic range. A review by Gallagher and colleagues focused on interventions that used integrated care including education as part of the approaches to care delivery in the AF population (26). They were able to include 1383 patients with AF and found that integrated care was associated with a decrease in cardiovascular hospitalisations and all-cause mortality. More research in the field is however needed since the conclusion was based on only three studies (26).

The diversity in the included interventions makes it difficult to recommend any specific content or mode of delivery of patient education that should be provided for patients with AF. The interventions in the included trials of this review included information on AF and treatment, information on symptoms and how to react appropriately when symptoms occur, how having AF can affect the patient's everyday life, and psychological reactions to living with a non-predictable disease (19–22,24,26,27). Studies used e-health solutions, nurse-led intervention (both individually, home based, and group based) and pamphlets. Also, outcomes varied and included, e.g. medication adherence, improved life with AF, patient involvement in treatment options, symptom burden management and lifestyle changes.

Important outcome effects were detected despite the differences in intervention content and outcome measures, thus proving that the education provided was relevant and effective. Future research should focus on teasing out which intervention components has the greatest impact in relation to different endpoints. Most importantly, patients should be consulted and invited as co-creators of educational programs as they undoubtedly are the real specialist when it comes to defining the educational needs (37,38).

To be able to implement any intervention it is crucial that the intervention is described in detail and preferably also the educational theory behind the education intervention is described and justified. That was the case for some of the included studies. The study by Hendriks and colleagues were built on the chronic care model (39,40), and the psycho-educational intervention in the study by Risom and colleagues was

developed with inspiration from the theory developed by Rosemary Parse (41). The intervention by Beyth and colleagues (42) was built on social learning theory (43–45) and experimental evidence (46,47). Educating our patients is complex and challenging, studies show that patients do not remember all the information they get at the hospital (48,49), therefore it would be preferable to be able to implement thoroughly tested educational interventions built on solid educational theory to be able to gain the best possible outcomes for the patient.

When delivering an educational intervention for patients with AF, healthcare professionals must consider that AF is a complex disease, affecting patients differently and therefore several approaches to educational interventions can be needed for different patients and their various challenges. For example, Lunde et al. found in a review that low socioeconomic status in patients with AF was associated with poorer treatment, prognosis related to treatment, less knowledge of AF, poor psychological health and higher mortality (50). Low socioeconomic status has also been described as affecting AF patients' activation level of self-management in their own illness negatively, which had an impact on health status and educational attainment (51). A high level of activation increased AF patients' knowledge about their AF, and confidence in coping with lifestyle changes to improve their health (51).

If we compare the results of this review with results of interventions including education for patients with other heart disease it is interesting that a Cochrane review for patients with coronary heart disease (n= 76,864 patients) found limited evidence for educational intervention alone (52,53). Even so, the authors recommend education as a part of a comprehensive rehabilitation programme for patients with coronary artery disease also including exercise and psychological support in line with international guidelines and education is today a core part of the cardiac rehabilitation programmes all over the world (14,54,55).

Strength and limitations of this review

This is a comprehensive overview of the effect of patient education in patients with AF. A literature search was performed, rigorous data extraction and evaluation was executed independently and the whole process outlined to secure transferability.

The greatest strength is the number of studies and patients included in the evaluation of serious adverse events in where the meta-analysis showed that patient education lowered mortality and readmission significantly. With regards to the rest of the outcomes the biggest concern is the limited amount of studies, events, and included patients, and the variety in interventions, participants and common outcomes, and as a result, it was not possible to perform meta-analysis for all outcomes.

The majority of the included studies were single-centre studies including patients with various types of AF which potentially compromises the generalisability. Because of the small number of studies and lack of

availability of individual patient data subgroup analyses in relation to the sub-types of AF (i.e., first-diagnosed AF, paroxysmal AF, persistent AF, long-standing persistent AF and permanent AF) could not be performed.

The interventions in the included studies consisted of different forms of education, some thoroughly described and some poorly described and therefore reproducibility might be challenged. The random-effects meta-analysis approach was used because of a substantial between-trial heterogeneity. The premises for the random-effects model is that studies are weighted much more equally and thereby applying the most conservative approach to the estimates reported (16). Most studies had blinded randomisation procedures and outcome assessment, but interventions were not blinded to participants, again threatening risk of bias.

We did not find any studies including patients with atrial flutter and therefore results may not be transferable to that population. One of the authors (SSR) of this review is also the first author of one of the included trials (22). To limit bias two other authors (PP and IQ) screened studies for inclusion and assessed data extraction, and judged risk of bias for the trial.

Conclusion and perspectives

Participating in an educational intervention seem to decrease the number of serious adverse events in patients with AF compared to patients in the control groups. For health-related quality of life several studies found differences between groups in favour of patient education, but other studies found no difference between groups. This was also the case for anxiety, depression, and physical activity thus no final conclusions can be made for theses outcomes.

For clinical practice, the results of this review are important since implementing educational interventions in rehabilitation programmes for patients with AF is far from systematically implemented. This review summarises the evidence and provides clinicians with an overview of interventions for implementation. Still, large well-designed and well-described randomised trials are warranted to inform clinicians and health care policy makers on appropriate and effective education for patients with AF to implement in the clinics.

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Declaration of Conflicting Interests

The authors declare that there is no conflict of interest, besides Signe Stelling Risom who is both one of the authors of this review and one of the authors of an included trial in this review.

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Tables

Table 1: AMSTAR assessment for the two included systematic reviews

Study	Was an 'a priori' design provided?	Was there duplicate study selection and data extraction?	Was a comprehensive literature search performed?	Was the status of publication (i.e. grey literature) used as an inclusion criterion?	Was a list of studies (included and excluded) provided?	Were the characteristics of the included studies provided?	Was the scientific quality of the included studies assessed and documented?	Was the scientific quality of the included studies used appropriately in formulating conclusions?	Were the methods used to combine the findings of studies appropriate?	Was the likelihood of publication bias assessed?	Was the conflict of interest included?	Global rating
Clarkesmith et al.,2017 (27)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Gallagher et al., 2017 (26)	No	Yes	Yes	Yes	Not applicable	Yes	Yes	Yes	Yes	Yes	Yes	High

Table 2a: Risk of Bias table for the randomised controlled trials

Study	Sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Clarkesmith et al. 2013 (23)	Low risk	High risk	Unclear risk	Low risk	High risk	Low risk	Unclear risk
Fuenzalida et al. 2017 (19)	Low risk	Low risk	Unclear risk	High risk	Low risk	Unclear risk	Unclear risk
Guo et al. 2017 (20)	High risk	High risk	High risk	High risk	High risk	Unclear risk	Unclear risk
Hendriks et al. 2012 (24)	Low risk	Low risk	High risk	Unclear risk	Unclear risk	Unclear risk	Unclear risk
Malm et al. 2018 (21)	Low risk	Low risk	High risk	Low risk	High risk	Low risk	Unclear risk
Risom S al. 2016 (22)	Low risk	Low risk	High risk	Low risk	High risk	Low risk	Low risk
Stewart et al. 2015 (25)	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Low risk
Bowyer et al. 2016 (29)	Low risk	Low risk	High risk	Low risk	Low risk	Low risk	Unclear risk

Table 2b: Risk of Bias table for the non-randomised interventional study

Study	Bias due to confounding	Bias in selection of participants	Bias in classification of interventions	Bias due to deviation from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of the reported results	Overall bias
Carter et al. 2016 (28)	Low risk	Low risk	Low risk	Low risk	Moderate risk of bias	Low risk	Low risk	Low risk

Table 3. Characteristics of included trials and systematic reviews

First author, year of publication and study design	Diagnosis	No. of (I/C) † participants, mean age (mean age in groups)	Intervention Type, dose, duration	Control	Follow-up	Outcome(s) (1) Primary, (2) Secondary	Key findings (1) Primary, (2) Secondary
Malm et al., 2018 (21) Randomized clinial trial	AF	56/55 67.2 (66.9/67.5)	Dyadic (with spouses) cognitive behavioural therapy – 3 times 2.5-hour group sessions over a period of 9 weeks	TAU‡ based on guidelines	12 months	(1) Health-related quality of life [Euroqol questionnaire (EQ-5D)]. (2) Psychological distress, sense of coherence [Hospital anxiety and depression scale (HADS) and sense of coherence scale (SOC-13)].	(1) Higher health related quality of life in the intervention group mediated by sense of coherence (2) Sense of coherence was better in the intervention group
Fuenzalida et al., 2017 (19) Randomized clinial trial	AF	116/124 76.1 (74.8/77.3)	Education at discharge including information about AF, treatment, precautions and warning sign, as well as pulse taking training	TAU‡ based on guidelines	3 and 12 months	(1) Composite end-point: AF-related or treatment-related complications and death at 12-months [Clinical records].	(1) Lower incidence of AF-related or treatment-related complications and death at 12-months in the intervention group

†: I = Intervention, C = Controls, ‡: Treatment as usual, §: Cluster randomisation design, ‖Treatment as usual content not described.

			and an individualised information leaflet				
Guo et al., 2017 (20)[§] Randomized clinial trial	AF	113/96 69.2 (67.4/70.9)	Smartphone AF application (mAF app) including clinical decision support, education and patient involvement self-care components and structured follow-up components	TAU[‡]	1 and 3 months	(1) Patients knowledge [The atrial fibrillation knowledge scale]. (2) Quality of life, drug adherence and anticoagulant satisfaction [Euroqol questionnaire (EQ-5D-Y), Pharmacy Quality Alliance adherence measure and the Adapted Anticoagulant Satisfaction Questionnaire].	(1) Knowledge higher in the intervention group (2) Drug adherence, anticoagulation and quality of life improved in the intervention group
Clarkesmith et al, 2017 (27) Systematic review	AF	11/2246	Educational, self-management and behavioural interventions such as: Educational booklets, videos, INR self-monitoring, decision aids, talking interventions, cognitive behavioural therapy, motivational	TAU[‡] based on guidelines	3, 6 and 12 months	(1) Target therapeutic range (TTR) (not relevant for this review). (2) Major bleeding, stroke and thromboembolic events, quality of life; psychological well-being (anxiety and Depression) and others e.g. illness belief and changes in perception (not relevant for this review).	(1) The effect of self-monitoring plus education on TTR was uncertain compared with usual care. (2) Few adverse events were reported in the included studies. Small but positive effects of education on anxiety and depression compared with usual care were found. The effect of decision aids on decision conflict favoured usual care.

			interviewing, heart rate variability biofeedback. From 30-60 minutes sessions one time to 30-120-minute sessions up to four times.				
Gallagher et al, 2017 (26) Systematic review	AF	3/1383	Integrated care including a nurse led, cardiologist supervised clinic or home-based visit plus education and referral package. Dose not reported.	TAU‡ based guidelines	1.8 to 2.5 years	All-cause mortality, Cardiovascular Disease related hospitalisation, AF-related hospitalisation, Cerebrovascular events, patient -reported outcomes such as quality of life, anxiety and depression.	Use of integrated care was associated with a reduction in all-cause mortality and cardiovascular hospitalisations but did not significantly impact on AF-related hospitalisations or cerebrovascular events.
Bowyer et al., 2016 (29) Randomized clinial trial	AF	22/19 62.1 (58.3/63.9)	Educational intervention, 5 prespecified time points, information, goal of treatment, procedural review, lifestyle modification, 3 months	TAU‡ based on guidelines	6 months	(1) Symptoms severity and frequency by the Symptom Severity Checklist (2) Health Related Quality of Life by the Short Form 36 General Health Survey (SF-36).	(1) Two of the eight subscales, Vitality and Physical Functioning improved in the intervention group (2) Seven components on the severity checklist showed improvement in favor of the intervention group.

Carter et al., 2016 (28) Non-randomised interventional study	AF	185/228 63.8 (63.6/64)	Early education via telephone 48-72 hours after referral from the emergency department. Group teaching session on AF. The induvial AF patient were discussed by the AF clinic team, prior to the appointment. Letter to family physician indicating referral to AF clinic, approximate wait time, pending investigations, recommendations regarding rate control and oral anticoagulation use if appropriate.	TAU‡ based on guidelines	12 months	(1) A composite of death from any cause, cardiovascular hospitalization, or AF-related emergency department visit at 12 months. (2) The individual components of the primary outcome, stroke, major bleeding, minor bleeding, and the degree of adherence to practice guidelines.	(1) The primary outcome occurred in 34 of 185 (18.4%) patients in the AF clinic, compared to 65 of 228 (28.5%) patients in the usual-care group (OR 0.57; 95% CI [0.35, 0.9] P=0.017). (2) Lower rates of major bleeding, minor bleeding, and stroke were seen between the two groups, these were not statistically significant. Guideline adherence was significantly improved in the areas of oral anticoagulation, etiology, and associated conditions with AF.
Risom et al., 2016 (22) Randomized clinial trial	AF	105/105 59 (60/59)	Comprehensive cardiac rehabilitation including physical exercise	TAU‡ based on guidelines	1, 4 and 6 months	(1) Physical capacity [Ergospirometry testing (CPET)]	(1) A significant difference was found on VO2 peak testing in favor of the intervention group.

			training (12 weeks, 3 times weekly) and 4 psycho-educational consultations			(2) Self-rated mental health, safety and serious adverse events [Short-Form 36 questionnaire (SF-36), Mental Component Score (MCS), Self-reported non-serious adverse events were registered by a patient reported questionnaire and serious adverse events through patients' records].	(2) No difference was found on SF-36, MCS. More non-serious adverse events were found in the intervention group, no difference between serious adverse events were found.
Stewart et al., 2015 (25) Randomized clinial trial	AF	168/167 72 (72/71)	Home visits and Holter-monitoring 7-14 days post-discharge with prolonged follow-up and multi-disciplinary support as needed	TAU‡ based on guidelines	12 and 24 months	(1) Composite end-points: event-free survival from all-cause death or unplanned admission [electronic health records].	(1) Compared with standard management patients in the intervention group experienced prolonged number of days alive and out of hospital but did not experience extended event-free survival.
Clarkesmith et al., 2013 (23) Randomized clinial trial	AF	46/51 72.9 (72.0/73.7)	One-off group session (1-6 patients) including 'expert-patient' DVD, educational booklet,	TAU‡ including standard information booklet	1, 2, 6 and 12 months	(1) Time within therapeutic (INR) range (TTR) at 6 and 12 months [blood sample]. (2) Knowledge, quality of life, anxiety/depression, beliefs about	(1) Intervention group had higher TTR in the intervention group at 6 months, but at 12 months differences were not statistically significant

			self-monitoring diary and worksheet			medication, illness perceptions [The Patient Knowledge Questionnaire, The Atrial Fibrillation Quality of Life Questionnaire, The Hospital Anxiety and Depression Scale (HADS-A and HADS-D),The Beliefs about Medication Scale, The Brief Illness Perception Questionnaire].	(2) Knowledge changed over time but not between groups. There were no significant differences in quality of life between or within groups. Anxiety and depression scores at all timepoints in both groups increased.
Hendriks et al., 2012 (24) Hendriks et al., 2014 (31) Randomized clinial trial	AF	356/356 66.5 (66/67)	AF clinic incl. individualized psychosocial support and education based on guidelines – 30-minute visits at 3, 6 and 12 months and every 6 months following, telephone contact optional.	TAU‡ based on guidelines	Mean 22 months	(1) Composite endpoint: cardiovascular hospitalization and cardiovascular death [Self-reported major adverse cardiovascular events and hospitalization and medical records]. (2) Adherence to guideline recommendation (of AF clinic nurses), Patient-reported: Quality of life, AF knowledge, Anxiety and Depression [Medical records,	(1) The primary endpoints occurred in significantly more patients in the usual care group compared to the intervention group. (2) Adherence to guideline recommendations was significantly better in the intervention group. Quality of life improved over time with no significant differences between the groups and no statistically significant differences for anxiety or depression were

						36-Item Short-Form Questionnaire (SF-36), the Hospital Anxiety and Depression Scale (HADS), the AF knowledge scale].	observed between both groups over time.

Figure Legends

Figure 1: Flow chart.

Figure 2: Forrest plot for serious adverse events (death and readmission).

Figure 3: Forrest plot for anxiety, 12-months follow-up.

Figure 4: Forrest plot for depression, 12-months follow-up.

Figure 1

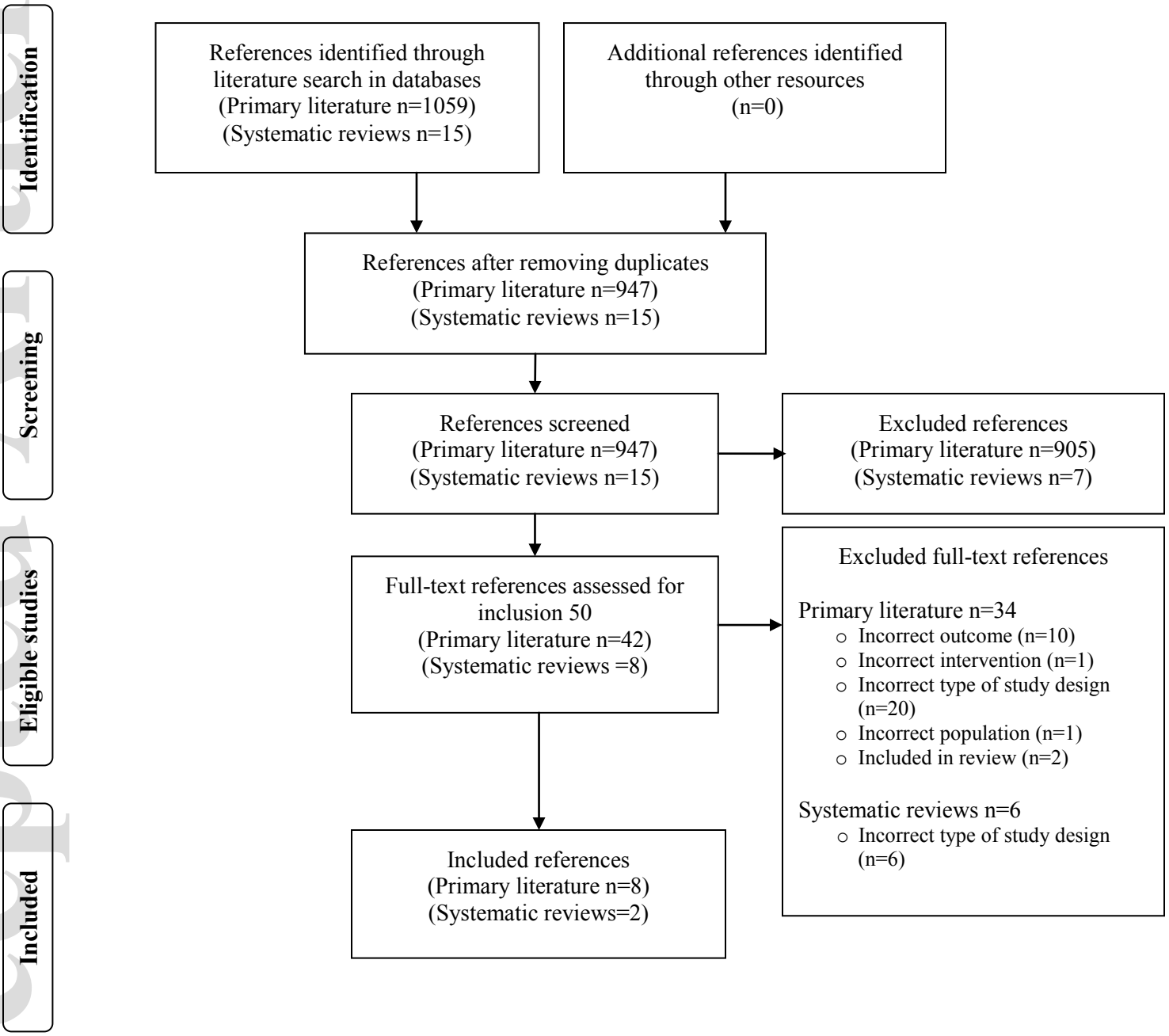

Figure 2

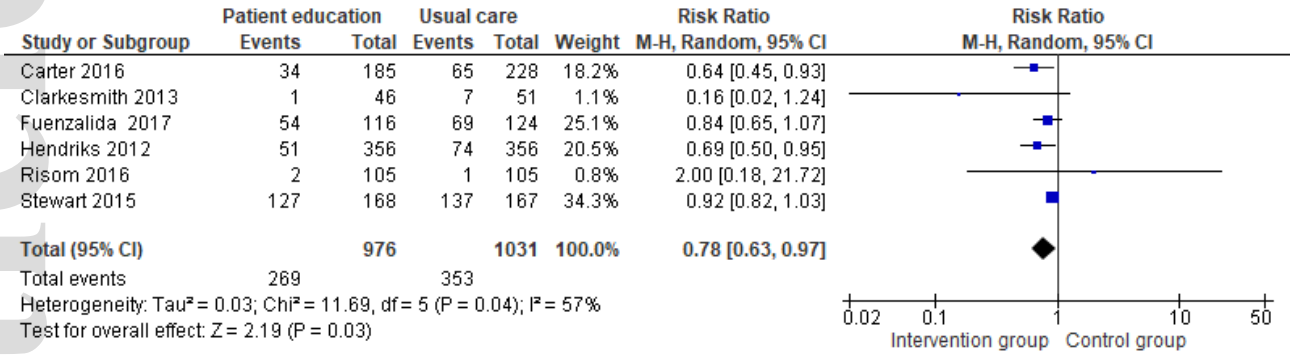

Figure 3

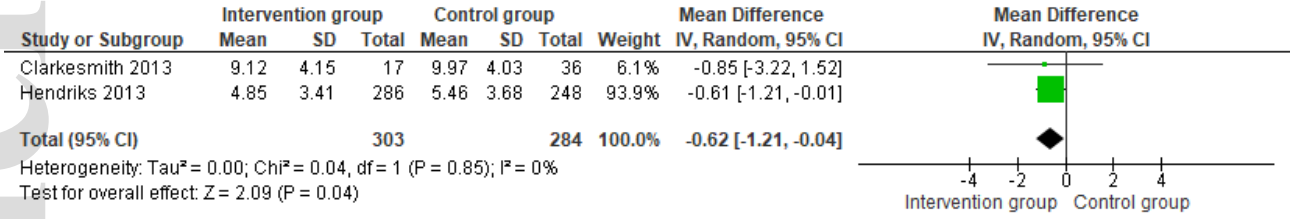

Figure 4