

ORIGINAL RESEARCH

A Nurse-led Approach to Improving Cardiac Lifestyle Modification in an Atrial Fibrillation Population

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ABSTRACT. Atrial fibrillation (AF) is a major public health problem and the most common cardiac arrhythmia encountered in clinical practice at this time. AF is associated with numerous symptoms such as palpitations, shortness of breath, and fatigue, which can significantly reduce health-related quality of life and result in serious adverse cardiac outcomes. In light of this, the aim of the present pilot study was to test the feasibility of implementing a mobile health (mHealth) lifestyle intervention titled “Atrial Fibrillation and Cardiac Health: Targeting Improving Outcomes via a Nurse-Led Intervention (ACTION),” with the goal of improving cardiac health measures, AF symptom recognition, and self-management. As part of this study, participants self-identified cardiac health goals at enrollment. The nurse used web-based resources from the American Heart Association (Dallas, TX, USA), which included the Life’s Simple 7® My Life Check® assessment, to quantify current lifestyle behavior change needs. Furthermore, on the My AFib Experience™ website (American Heart Association, Dallas, TX, USA), the patient used a symptom tracker tool to capture the date, time, frequency, and type of AF symptoms, and these data were subsequently reviewed by the cardiac nurse. Throughout the six-month intervention period, the cardiac nurse used a motivational interviewing approach to support participants’ cardiac health goals. Ultimately, the ACTION intervention was tested in 53 individuals with AF (mean age: 59 ± 11 years; 76% male). Participants were predominantly overweight/obese (79%), had a history of hypertension (62%) or hyperlipidemia (61%), and reported being physically inactive/not performing any type of regular exercise (52%). The majority (88%) of the participants had one or more Life’s Simple 7® measures that could be improved. Most of the participants (98%) liked having a dedicated nurse to work with them on a biweekly basis via the mHealth portal. The most commonly self-reported symptoms were palpitations, fatigue/exercise intolerance, and dyspnea. Seventy percent of the participants had an improvement in their weight and blood pressure as documented within the electronic health record as well as a corresponding improvement in their Life’s Simple 7® score at six months. On average, there was a three-pound (1.36-kg) decrease in weight and a 5-mmHg decrease in systolic blood pressure between baseline and at six months. In conclusion, this pilot work provides initial evidence regarding the feasibility of implementing the ACTION intervention and supports testing the ACTION intervention in a larger cohort of AF patients to inform existing AF guidelines and build an evidence base for reducing AF burden through lifestyle modification.

KEYWORDS. Atrial fibrillation, nursing, quality of life, telemedicine.

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Rhythm Management

Introduction

Atrial fibrillation (AF) is a major public health problem and the most common cardiac arrhythmia encountered in clinical practice. In 2017, the estimated prevalence ranged from 2.7 million to 6.1 million in the United States and is projected to grow to 12 million by 2030.¹ In addition, AF is responsible for approximately 100,000 deaths² and 500,000 hospitalizations annually^{2,3} and is associated with a fivefold increased risk of stroke,⁴⁻⁷ a threefold increased risk of heart failure,⁸⁻¹⁰ and an increase in all-cause mortality.^{5,11-13} The burden of AF is currently epidemic and anticipated to grow in prevalence due to an aging population that is living longer with multiple comorbid conditions associated with the development of AF.^{14,15} Moreover, AF has been linked with numerous symptoms such as palpitations, shortness of breath, and fatigue, all of which can significantly reduce health-related quality of life (HRQoL).¹⁶ Symptom reduction or elimination is a major goal of AF management, which relies on correctly identifying signs and symptoms of AF.¹⁷ However, AF symptom recognition is challenging, especially in AF populations with multiple coexisting cardiac conditions that exhibit similar symptoms, such as heart failure.

Treatment and management of atrial fibrillation

Catheter ablation is widely used in clinical practice to treat symptomatic AF.¹⁸ This treatment uses radiofrequency energy or “freezing” to destroy areas causing AF in the heart.¹⁹⁻²² Despite the efficacy of catheter ablation to maintain sinus rhythm, however, 20% to 45% of patients who undergo catheter ablation experience recurrent AF.^{23,24} Electrical cardioversion is another established therapy for the treatment of AF and the maintenance of sinus rhythm. AF recurrence is also common after treatment with this approach, even when patients are receiving additional pharmacological antiarrhythmic therapy to maintain sinus rhythm; about 40% to 60% of patients demonstrate AF recurrence within three months, whereas 60% to 80% experience such within one year after cardioversion.^{25,26} Even a decade after the National Institutes of Health held a special workshop on the prevention of AF and recommended focusing on interventions that prevent AF recurrence,²⁷ there remains a paucity of evidence-based, preventative interventions.

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Impact of atrial fibrillation on health-related quality of life

AF has a significant effect on HRQoL, impacting both physical and psychological well-being. Symptoms affecting HRQoL that are commonly associated with AF, such as fatigue, shortness of breath, and palpitations, may also be associated with coexisting cardiovascular conditions like heart failure, making both distinguishing symptoms and management challenging for both patients and providers. Thus, many AF patients, particularly those who are older, fail to recognize and distinguish symptoms associated with AF, ultimately hindering timely treatment and putting them at risk for complications.²⁸

Evidence supporting a healthy cardiac lifestyle reduces atrial fibrillation

It is estimated that a large percentage of AF could be attributed to modifiable risk factors such as hypertension (22%), overweightness/obesity (13%), smoking (10%), and diabetes (3%).^{15,29-36} Among patients with a history of AF, there is a 10% to 29% increase in the risk of postablation AF recurrence for every five-unit increase in body mass index.³⁷ Previous research supports the effectiveness of lifestyle modification to improve cardiac health,³⁸⁻⁴⁰ and nurses are ideally qualified to implement and evaluate such programs in clinical practice.^{32,41,42}

Lifestyle modification that results in risk factor reduction in AF patients with a body mass index of greater than 27 kg/m² and at least one other cardiac risk factor (eg, hypertension, diabetes mellitus, smoking, excessive alcohol consumption) has been shown to lead to a drop in AF recurrence and an improvement in patient symptoms.⁴³ AF severity, number of AF episodes, cumulative AF duration and recurrence, and medication noncompliance can be reduced when blood pressure, weight, and glucose are well-controlled.^{38,39,43-46} In addition, for patients undergoing treatment by way of catheter ablation for symptomatic AF, a lifestyle-modification intervention resulted in a significant improvement in symptoms after catheter ablation as determined by AF severity score.⁴⁷ The need to address lifestyle modification explicitly highlights a gap in clinical practice and an opportunity for nurses to play a critical role.

Motivational interviewing is grounded in client-centered counseling, cognitive behavioral therapy, and social cognitive therapy.⁴⁸ A motivational interviewing approach is characterized by expressing empathy, developing a discrepancy between belief and behavior, rolling with resistance, and supporting self-efficacy.⁴⁹ One of the goals of motivational interviewing is to help individuals work through the ambivalence present in unhealthy behaviors and to help them verbally express their own reasons for or against change.⁴⁹⁻⁵¹ Several other researchers have demonstrated the benefits of motivational interviewing in changing cardiovascular behaviors and achieving personal cardiac goals.⁵²

This evidence supports the need for a nurse-led cardiac lifestyle modification program in clinical practice.^{32,41,42}

The aim of the present pilot study was to test the feasibility and preliminary efficacy of a mobile health (mHealth) lifestyle intervention titled “Atrial Fibrillation and Cardiac Health: Targeting Improving Outcomes via a Nurse-Led Intervention (ACTION)” that incorporated the Life’s Simple 7[®] and My AFib Experience[™] web-based tools (American Heart Association, Dallas, TX, USA) to improve cardiac health measures, AF symptom recognition, and self-management by utilizing motivational interviewing.

Materials and methods

Study setting

The study was approved by the Columbia University Medical Center (CUMC) Institutional Review Board and took place at the CUMC facility located in northern Manhattan in New York, NY. A trained bilingual (fluent in English and Spanish) research coordinator screened for eligible subjects from the cardiology/electrophysiology service. All participants had a history of paroxysmal or persistent AF. Patients who met the inclusion criteria were enrolled after their primary health-care provider had been made aware of the study protocol and informed consent was obtained.

Study methods

An adapted version of the Information–Motivation–Behavioral Skills Model guided this research (Figure 1).⁵³

When information [eg, electrocardiogram (ECG) data, symptoms] and motivation were tailored to improving individual’s health behavior and self-management strategies through the ACTION intervention, these activities were more likely to be integrated into daily routines and potentially result in enhancing symptom recognition and distinguishing symptoms due to AF versus other coexisting conditions. It was thought that this could lead to further improved health changes, (eg, improved self-management of cardiac lifestyle and symptoms) and might potentially improve an individual’s self-recognition of AF and Life’s Simple 7[®] score (Figure 2).

Participants

For the purposes of this single-arm pilot study, a convenience sample of 53 participants was included. All study participants continued their clinical management and follow-up as determined by their respective providers.

Baseline

At baseline, each participant completed the Life’s Simple 7[®] assessment (American Heart Association, Dallas, TX, USA). All participants selected lifestyle modification areas from the Life’s Simple 7[®] that they believed they “could act on” or address (eg, physical activity, weight control, eating better) over the six-month study period.

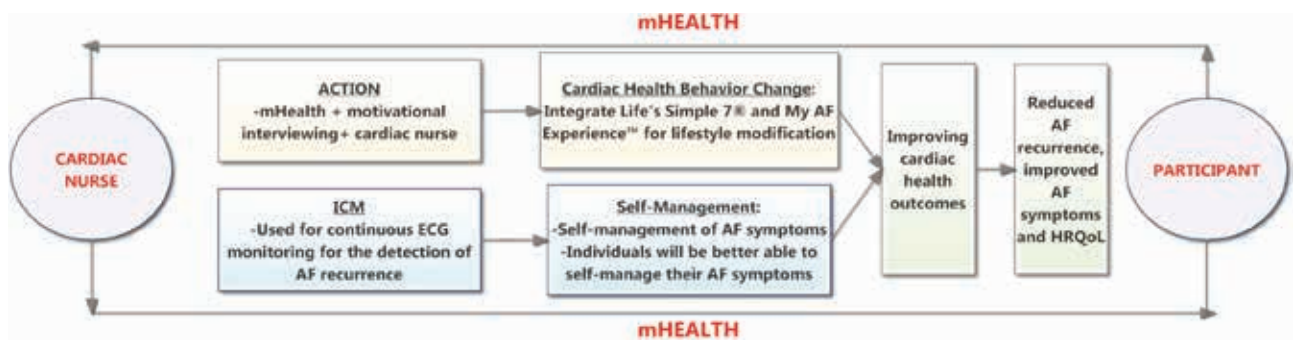


Figure 1: Adapted information–motivation–behavioral skills conceptual model.

The American Heart Association copyrighted content use policy prevents the display of copyrighted images in open-access online publications. Please visit the American Heart Association (<https://www.heart.org>) for more information on its Life’s Simple 7[®] application.

Figure 2: Life’s Simple 7[®] heart score.

Intervention

The ACTION intervention used a nurse-led motivational interviewing approach to identify patients' goals and align lifestyle and self-care management behaviors. This approach included telehealth communication with a nurse guided by the Life's Simple 7[®] My Life Check[®] program (American Heart Association, Dallas, TX, USA) to quantify current lifestyle behaviors as well as use of the My AFib Experience[™] web-based resource (American Heart Association, Dallas, TX, USA), which provides a plethora of resources for AF patients to consider. For the purposes of this study, participants utilized the My AFib Symptom Tracker via the My AFib Experience[™] website (American Heart Association, Dallas, TX, USA) to capture the date, time, frequency, and type of their AF symptoms. The purpose of the intervention was to improve cardiac health measures, AF symptom recognition, and self-management.

The ACTION intervention was delivered via a secure portal in 30-minute weekly sessions over six months. For each ACTION session, the cardiac nurse and participant connected in a video chat format at a prescheduled date/time via the portal, and an ACTION session was conducted. This time frame was based on previous work that showed that a similar time period is reasonable for a behavioral intervention and for collecting the proposed study endpoints.^{43,54–56}

Using a motivational interviewing approach, the cardiac nurse reviewed and discussed lifestyle modification and self-management strategies incorporated by the participant since the previous session. Resources from the aforementioned American Heart Association material were used to guide the sessions, which were personalized to each patient's individual cardiac goals. Participants completed the My AFib Experience[™] Symptom Tracker (American Heart Association, Dallas, TX, USA) during the study period, which allowed them to record the date, time, frequency, and type of any symptoms they experienced related to AF. These symptoms included palpitations/racing heart, shortness of breath, and/or lightheadedness. Participants documented whether symptoms occurred at rest or during exercise as well as their severity and frequency.⁵⁷ This helped guide patients to better self-recognize symptoms and triggers associated with AF versus other coexisting conditions.

Statistical analysis

Demographic and clinical data are reported as means and standard deviations for continuous variables and as frequencies and percentages for categorical variables. Changes in weight and systolic blood pressure were assessed by paired t-test. Analyses were performed using the SAS version 9.4 software (SAS Institute, Cary, NC, USA). A critical p-value of 0.05 was used for significance in all analyses.

Results

As part of the present study, we successfully piloted the ACTION intervention in 53 individuals with AF (mean age: 59 ± 11 years; 76% male; 60% white) (Table 1). Almost all participants (98%) reported liking having a dedicated nurse work with them on a biweekly basis via the mHealth portal to help them improve their cardiac health and AF recognition. However, some participants reported that they desired more frequent contact (55%) with the nurse.

Most of the participants (86%) chose increasing physical activity as the primary health goal that they could improve upon, followed by eating a better/healthier diet (65%). Seventy percent of the participants demonstrated an improvement in their weight and blood pressure, as documented in the electronic health record, as well as a corresponding improvement in their Life's Simple 7[®] score from baseline to six months. On average, there was a 3-lb ± 13-lb (1.36-kg ± 5.90-kg) decrease in weight and a 5-mmHg decrease in systolic blood pressure from baseline to six months. The overall compliance rate was approximately 65% for the entire cohort. However, for participants with a loop recorder, the compliance rate increased to 76%. On average, participants who received intervention had a one-point improvement in Life's Simple 7[®] score over the six-month period. In addition, 70% of the participants improved their Life's Simple 7[®] score by one or two points from baseline to six months. Furthermore, 81% of the participants reported that the ACTION intervention enhanced accessibility, eliminated extra in-person visits, and provided personalized cardiac health information in achieving "my health goals," whereas 86% reported they found the digital ACTION session to be as good as an in-person meeting with the nurse practitioner. Three people did not have Internet access in their home and used the laptop/Wi-Fi of a

Table 1: Patient Demographics

Parameter	Patient Data
Age (mean ± standard deviation)	59 ± 11 years
Male gender	76%
Race	
White	60%
Hispanic	29%
Black	3%
One or more races	8%
Clinical history	
Overweight/obese	79%
Hypertension	62%
Hyperlipidemia	61%
Physically inactive	52%
One or more of the Life's Simple 7 [®] measures identified at baseline*	88%

*Life's Simple 7[®] is a web-based resource of the American Heart Association (Dallas, TX, USA).

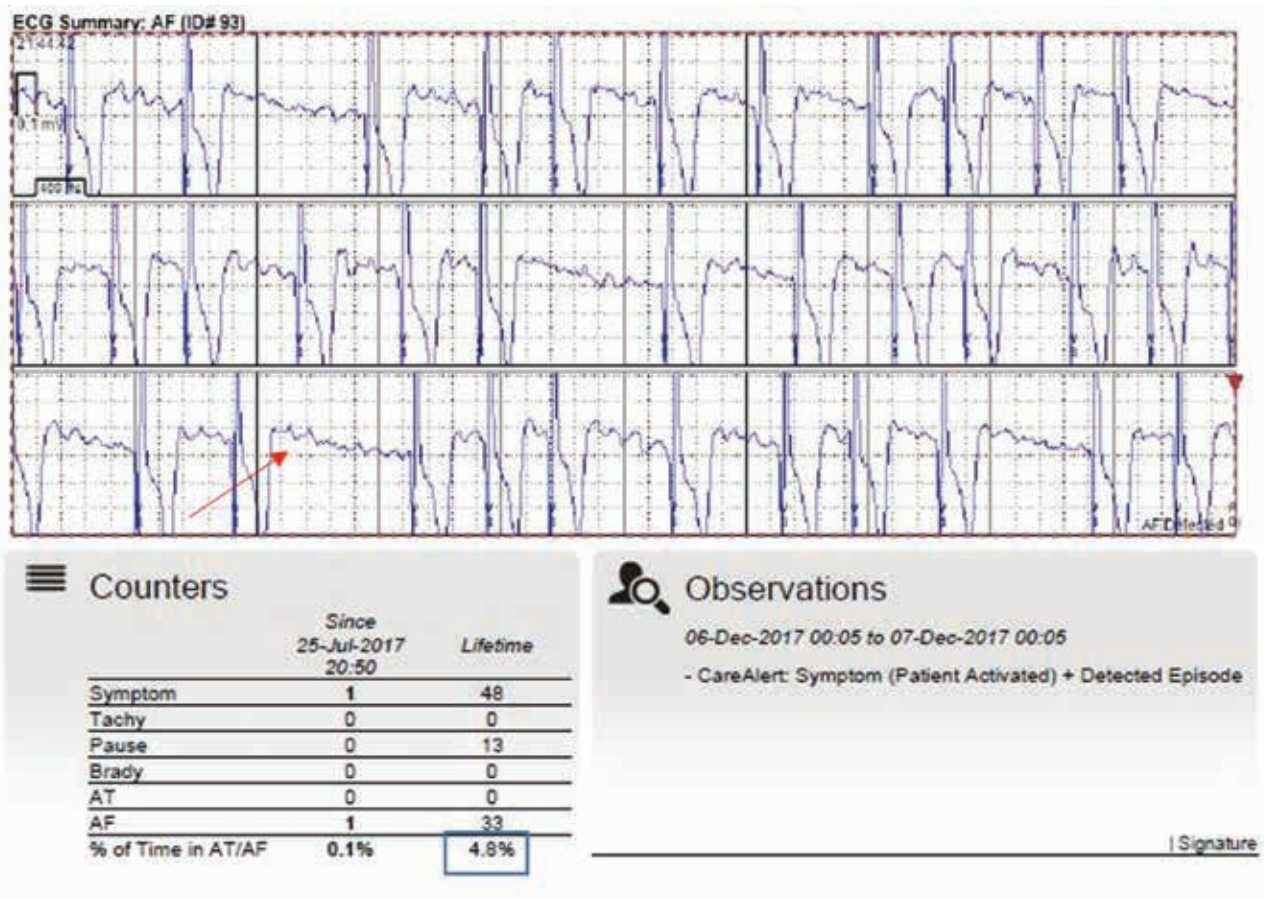


Figure 3: Sample ECG report generated by the ICM. The red arrow highlights AF captured by the ICM, in the setting of active symptoms. The blue box shows the lifetime percent of AF recurrence recorded by the ICM.

family member/or neighbor to complete the ACTION sessions. The “human connection” provided by the nurse coupled with the motivational interviewing was noted by participants as the most essential component, and most of the participants (98%) reported that working with a nurse helped keep them to better stay on track with sustaining a healthy lifestyle and with overall AF management.

Forty-nine percent of the participants had undergone at least one prior cardioversion attempt, 23% had undergone at least one prior ablation, and 17% had undergone both prior ablation and cardioversion. All participants who reported undergoing a prior ablation session had previously also undergone an unsuccessful cardioversion attempt or participated in unsuccessful antiarrhythmic drug therapy. There was no significant change in antiarrhythmic drug therapy from baseline to six months, with 28.3% of patients on antiarrhythmic drugs. Forty-one percent of study participants had an implantable cardiac monitor (ICM) device placed as part of their clinical care following ablation or cardioversion. Regular transmission or transmission initiated by the patient in response to symptoms allowed for the easy transfer of information stored in the device to a central database via the web, where the information was viewed by providers

and treatment and management were subsequently provided as needed (**Figure 3**). In fact, 70% of the participants who self-initiated an ICM transmission did so in the setting of symptoms. The most common symptoms that resulted in an ICM transmission that correlated with AF, atrial flutter, or other arrhythmia being documented on the ECG were palpitations (83%), shortness of breath (81%), and fatigue/exercise intolerance (74%). Most of the participants (91%) reported two or more of these symptoms occurring together, which prompted them to send an ICM transmission to their practitioner for review. Interestingly, 30% of our participants self-reported forgetting to take one or more of their cardiac medications (eg, β -blocker, anticoagulation, diuretic) over the six-month study period and only remembered that they had forgotten to do such upon experiencing symptoms.

Discussion

The purpose of the present study was to evaluate the feasibility and preliminary efficacy of the ACTION intervention delivered in a single-arm pilot study of AF patients in a large, urban academic medical center. Participants who received the mHealth lifestyle intervention showed

improved quantifiable cardiac health measures, such as blood pressure and weight, and AF symptom recognition over a six-month interval. Participants reported that working with a nurse practitioner via a digital portal helped them to stay motivated and focus more on improving their health. In addition, participants with a clinically indicated ICM for AF management were better able to recognize and distinguish their AF symptoms and associated triggers/behaviors.

Lifestyle modification as measured by the Life's Simple 7[®] assessment and the My AFib Experience[™] website (American Heart Association, Dallas, TX, USA) improves cardiac health by promoting adherence to behavior change, enhancing self-management skills, and empowering patients to actively engage in their care.⁵⁸⁻⁶¹ During the short six-month period of this investigation, there was a one-point improvement in Life's Simple 7[®] score. Given a longer study period, it is possible that this improvement would have increased as patients gained more control over their cardiac risk factors and became more engaged in their health care. In addition, while smoking is one of the Life's Simple 7[®] measures, there were no active smokers in the cohort. As such, smoking was not a potential area of improvement in terms of Life's Simple 7[®] score in this study. Other researchers have found that blood pressure, weight loss, and glucose control reduce AF symptom severity, number of AF episodes, and cumulative AF duration and recurrence.^{38,39,43-46} This evidence supports the need for the incorporation of nurse-led cardiac lifestyle modification programs into clinical practice.^{41,42,62} Other evidence has suggested a nurse-led AF mHealth intervention for AF improves self-management, symptom recognition, HRQoL, and self-recognition of AF.⁶³ The compliance rate was similar to that in other studies regarding the use of motivational interviewing for the management of cardiovascular risk factors, which have demonstrated adherence rates ranging from 55.1% to 73.7%.^{64,65} Due to our small sample size, no statistical correlation between compliance and results could be confirmed; however, the increased compliance of the participants with loop recorders is likely an outcome of these participants being more highly engaged with the technology. These individuals became more interested in improving their overall cardiac health by using the patient activator to document arrhythmia symptoms and correlate these symptoms with documented arrhythmias, increasing the likelihood of them remaining compliant.

Regular contact with cardiac nurse practitioners enhanced pharmacologic therapy, including the regulation of β -blocker and antiarrhythmic medications, to better control heart rate and symptoms. Along with lifestyle modification strategies, nurse practitioners often addressed proper anticoagulation and compliance with other medications prescribed for AF and underlying comorbidities. During the sessions, participants often mentioned changes in underlying coexisting conditions that might necessitate a change in medication or treatment, or the participants called members of the research team or the nurse practitioners to report changes in their health

status during the study period. This point was essential because, with improper use of or noncompliance with their medication, combined with a lack of awareness of new or worsening symptoms, medical conditions such as heart failure might not have become known to physicians without continued oversight until a subsequent visit, possibly resulting in untoward outcomes.

Although multiple evidence-based cardiac lifestyle resources exist, they are not integrated and lack a personalized lifestyle approach that takes into account individual preferences and whose progress is driven by the patient. For example, with regard to medication adherence, one participant joked that he forgets to take his medications sometimes, yet never forgets to walk his dog. Thus, a real-world strategy that worked was having his medication box placed right next to the dog leash.

A separate study of AF patients (n = 140) at CUMC by a member of our team found significant gaps in knowledge, both about AF in general and specifically about approaches for reducing AF risk factors (dissertation research; manuscripts in progress). For instance, 30% of patients did not know common AF triggers (eg, alcohol); 37% did not understand the rationale for taking anticoagulants; and 35% did not understand the risks associated with asymptomatic AF. Therefore, patient education and self-management guidance via a nurse-led intervention may be a medium for AF cardiac risk factor education and highlights the unique and innovative aspect of the ACTION intervention. Some evidence suggests that lifestyle intervention strategies with more frequent participant contact generally yield better outcomes,^{66,67} and personalized lifestyle modification with a "human component" is important in creating social support to motivate individuals to change their health behaviors.^{68,69} This observation is similar to our findings, wherein the majority of the participants reported the nurse as the most essential of the intervention components "that keep them motivated" in working toward their lifestyle health goals.

Likewise, researchers have also shown that human support is the most important component in the effectiveness of and adherence to behavior change interventions. Thoughtfully introducing a digital person-to-person component to replace clinic visits can provide the needed human support while diminishing the barriers of in-person meetings.⁶⁹ In fact, many patients report missing human interaction when clinical visits are totally replaced by technology, suggesting that it is an essential component of patient self-management.⁷⁰ While motivational interviewing has been successful for cardiac lifestyle modifications,⁷¹⁻⁷⁴ using a multicomponent mHealth cardiac lifestyle intervention that includes motivational interviewing with AF patients was an innovative aspect of our research study. Using motivational interviewing, the cardiac nurse could tailor the Life's Simple 7[®] and My AFib Experience[™] AFib Symptom Tracker web-based resources (American Heart Association, Dallas, TX, USA), discuss AF and cardiac lifestyle health goals, and

provide emotional support to facilitate positive behavior changes. In fact, 96% of the participants reported the ACTION intervention to be useful in facilitating and sustaining behavior changes and in “staying motivated.” Finally, our study results are similar to those of previous research that demonstrated that improving cardiac lifestyle⁷⁵ reduces AF recurrence and symptoms^{47,76} and that mHealth combined with human support is appropriate to promote lifestyle changes.^{77–83}

Data from the ICM (eg, frequency, duration, ECG pattern of AF) allowed for the identification of AF and its triggers and symptoms at the time of AF occurrence. The ECG transmission presented in **Figure 3** captured AF in the setting of the symptom of shortness of breath. In addition, this participant reported a stressful day at work and that he forgot to take his β -blocker on the day of the transmission. The additional data from the ICM allowed us to improve our understanding of the associations between the presence or absence of individual self-reported symptoms and medication adherence with β -blockers and antiarrhythmics. In this subgroup of participants, we were able to more precisely correlate symptoms and true AF events with additional details such as the time of day and potential triggers reported by the participant (eg, exercise, lack of sleep, stress) via the ICM.

Recent updates to the AF guidelines highlight adherence to prescribed AF treatments, especially anticoagulation, to be of the utmost importance in order to avoid AF-associated complications such as stroke.⁸⁴ In the Telephone Contacts to Improve Adherence to Dual Antiplatelet Therapy Following Drug-eluting Stent Implantation (EASY-IMPACT) trial, telephone support (ie, four telephone calls from a nurse) dramatically improved sustained medication adherence rates in patients who had received drug-eluting stents. After the first year, more than 90% of the patients who had received standard-of-care follow-up were adherent with their prescribed medication, whereas more than 99% of the patients who received telephone follow-up were adherent,⁸⁵ highlighting the impact of nurse-led interventions in improving medication adherence in cardiovascular populations. Finally, a small nurse-led pilot study conducted in Australia examined the use of an educational intervention at the time of AF ablation and found a positive effect on improving symptom recognition. Similar to the results of their work, we found that shortness of breath, exercise intolerance, and fatigue were common in our cohort as well.⁸⁶

In addition, nurse-led heart failure clinics have been shown to improve survival and self-care in patients with heart failure.⁸⁷ In a prospective randomized trial, patients assigned to a nurse-led cardiac clinic had fewer deaths, hospital admissions, and days in the hospital as well as higher self-care scores at both three months and 12 months.⁸⁷ Separately, the Australian Nurse-led Intervention for Less Chronic Heart Failure (NIL-CHF) study showed that the nurse-led interventions were associated with better cardiac recovery as well as reduced emergency

and unplanned readmission costs.^{88,89} This study differed from the present ACTION intervention in that it focused on heart failure and involved a nurse-led home- and clinic-based program as opposed to a telehealth intervention. ACTION was not primarily focused on heart failure and was instead primarily focused on an AF population with multiple cardiac risk factors. Moreover, the ACTION intervention's focus was on using motivational interviewing to encourage lifestyle modification, whereas the nurse-led interventions for heart failure, a chronic condition, are focused on the modification of therapy and hospital admission suggestions.⁹⁰

Study limitations

Although the above results are encouraging, some limitations do exist in our single-arm pilot study. For example, the sample size was small, there was no control group, and the study was conducted at a single center. Furthermore, although participants noted working with a nurse helped them to stay motivated on how to live with AF and maintain a healthy lifestyle, the association of underlying cardiac risk factors with AF over time was not systematically captured. In addition, the long-term effects of the nurse-led intervention on medication adherence and the burden of AF and associated symptoms remain unknown.

Conclusion

Findings from this pilot study provide initial evidence supporting a nurse-led lifestyle intervention delivered in a real-world setting and address the broader goals of the National Institutes of Health and Healthy People 2020 initiative to reduce morbidity and mortality.^{91,92} Knowledge from this pilot study supports the need to test the ACTION intervention in a larger AF cohort. This could ultimately provide further evidence to inform the existing AF guidelines about the impact of lifestyle modification on reducing AF burden and could be easily transferable into multiple settings and be widely adopted and disseminated in clinical practice to improve cardiac health and reduce the burden of AF in society in the future.

Future directions

It remains unknown as to what the optimal intervention frequency should be for AF patients to achieve quantifiable sustained improvements in cardiac health outcomes. The current study provides initial evidence for a larger randomized controlled trial to evaluate the efficacy and determine the optimal dose of a nurse-led lifestyle coaching intervention and contact frequency (ie, weekly, biweekly, or monthly) for AF patients to improve symptom recognition and cardiac health outcomes using a personalized approach. In addition, further studies are needed to examine the role of sex, age, ethnicity, and engagement with mHealth on the long-term effects of a nurse-led intervention for improving cardiac health, medication adherence, reducing symptom burden, rehospitalization rates, and cost.

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