JAFIB
Original Research
Journal of Atrial Fibrillation

www. jafib.com

Factors Associated with Moderate Physical Activity Among Older Adults with Atrial Fibrillation

Jordy Mehawej[1],Jane S.Saczysnki[2], Catarina I. Kiefe[3],Eric Ding[3], Hawa O. Abu[5],Darleen Lessard[3],Robert H. Helm[4], Benita A. Bamgbade[2], Connor Saleeba[1], Weijia Wang[1], David D. McManus[1], Robert J. Goldberg[3]

[1] *Division of Cardiovascular Medicine, Department of Medicine, University of Massachusetts Medical School, Worcester MA*
[2] *Department of Pharmacy and Health Systems Sciences, School of Pharmacy, Northeastern University, Boston MA*
[3] *Department of Population and Quantitative Health Sciences, University of Massachusetts Medical School, Worcester, MA*
[4] *Department of Cardiovascular Medicine,Boston University Medical, Boston, MA*
[5] *Department of Medicine, Saint Vincent Hospital, Worcester, MA*

Abstract

Objective: Engaging patients with atrial fibrillation (AF) in moderate-intensity physical activity has been encouraged by published guidelines. We examined factors associated with engagement in moderate physical activity among older adults with AF.

Methods: Data are from the SAGE (Systematic Assessment of Geriatric Elements)-AF study. Older adults (≥65 years) with AF and a CHA_2DS_2-VASc≥2were recruited from several clinics in Massachusetts and Georgia between 2015 and 2018. The Minnesota Leisure Time Physical Activity questionnaire was used to assess whether participants engaged in moderate-intensity physical activity (i.e. at least 150 minutes of moderate exercise). Logistic regression was utilized to examine the sociodemographic and clinical characteristics and geriatric elements associated with engaging in moderate-intensity physical activity.

Results: Participants were on average 76 years old and 48% were women. Approximately one-half (52%)of study participants engaged in moderate-intensity physical activity. Morbid obesity (adjusted OR [aOR]=0.41, 90%CI=0.23-0.73), medical history of renal disease (aOR=aOR=0.68,90%CI= 0.48-0.96), slow gait speed (aOR=0.44,90%CI=0.32-0.60), cognitive impairment (aOR=0.74, 90%CI=0.56-0.97), and social isolation (aOR=0.58, 90%CI= 0.40-0.84) were independently associated with a lower likelihood, while higher AF related quality of life score (aOR=1.64, 90%CI=1.25-2.16) a greater likelihood, of meeting recommended levels of moderate physical activity.

Conclusions: Nearly one-half of older adults with NVAF did not engage in moderate-intensity exercise. Clinicians should identify older patients with NVAF who are less likely to engage in physical activity and develop tailored interventions to promote regular physical activity.

Introduction

Atrial fibrillation (AF) is the most common cardiac arrhythmia, with an estimated prevalence of at least 33.5 million worldwide.[1] AF markedly decreases quality of life and increases the risk of stroke, heart failure, dementia, and death.[2-7] Lifestyle interventions, including participation in regular exercise and risk factor management, have been shown to benefit older patients with AF by decreasing their symptoms and improving their quality of life.[8-10]

Key Words:
Atrial fibrillation, Physical Activity, Moderate Exercise.

Corresponding Author:
JordyMehawej, M.D
Division of Cardiovascular Medicine, Department of Medicine&Department of Population and Quantitative Health Sciences, University of Massachusetts Medical School, University of Massachusetts Medical School, 55 Lake Avenue North, Worcester MA 01655, USA

Widely disseminated guidelines by national agencies encourage moderate - intensity physical activity in patients with AF yet advocate against chronic excessive endurance exercise among middle-age and older adults with AF.[11] Patients with AF who engage in moderate-intensity physical activity have a lower risk of CVD mortality compared with those who are inactive and moderate exercise has been shown to result in a lower risk of CVD mortality than strenuous exercise.[12] In addition, moderate-intensity physical activity has been shown to enhance quality of life, exercise capacity, and the ability to perform activities of daily living among adults with AF.[13] However, little is known about the extent of engagement in moderate exercise or the factors that may promote or hinder engagement in moderate exercise among older adults with AF. Understanding these facilitators or barriers would help clinicians identify patients with AF who are less likely to meet recommended levels of physical activity and develop tailored interventions to promote moderate-intensity physical activity in these individuals.

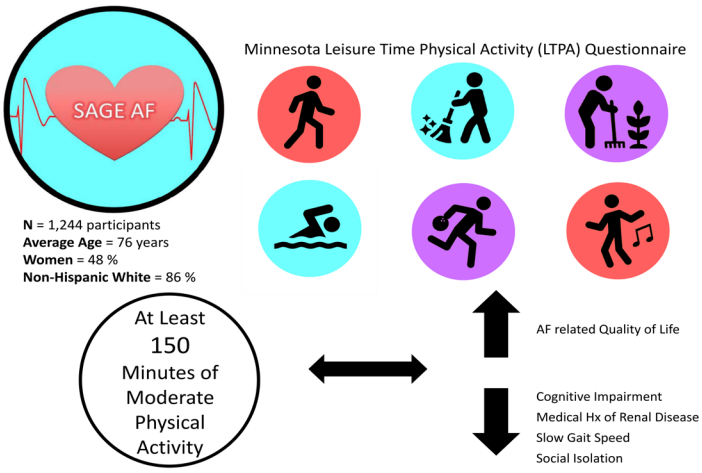

Figure 1: **Minnesota Leisure Time Physical Activity (LTPA) Questionnaire**

Using data from a large contemporary cohort, the Systematic Assessment of Geriatric Elements (SAGE)-AF study,[14,15] we examined the sociodemographic, geriatric, clinical, and patient reported elements associated with meeting recommended levels of moderate physical exercise.

Methods

Study Population

The data used for this cross-sectional analysis were derived from the prospective cohort study, Systematic Assessment of Geriatric Elements (SAGE) in AF.[14,15] Participants were recruited from multiple primary care and specialty care clinics in Massachusetts and Georgia between 2015 and 2018. Participants included were 65 years and older, diagnosed with NVAF, and had a CHA_2DS_2-VASc≥2 [16]. Patients with contraindications to oral anticoagulation, or on anticoagulation therapy for conditions other than AF, those with impaired decision making who were unable to provide written consent, or were non-English speakers were excluded. The Institutional Review Boards at the University of Massachusetts Medical School, Boston University, and Mercer University approved this study. Participants were enrolled into this observational study after providing written informed consent.

Measurement of Physical Activity

The Minnesota Leisure-Time Physical Activity (MLTPA) questionnaire was used to evaluate self-reported level of physical activity and was completed at the time of study enrollment.[17,18] The MLTPA questionnaire asks participants to self-report whether they haveper formed the following moderate activities during the prior 2 weeks: (1) walking at af airly brisk pace for exercise, (2) moderately strenuous household chores (i.e., scrubbing, vacuuming), (3)moderately strenuous outdoor chores (i.e., mowing or raking lawn, working in the garden), (4) dancing, (5) bowling, or (6) any regular exercise program other than walking such as stretching, strengthening exercises, or swimming. The questionnaire assesses the frequency (how many times) and duration (in minutes) participants spend doing each reported activity. The total duration of moderate exercise that participants engaged in on a weekly basis was calculated by adding the number of minutes that participants reported having performed each of the activities mentioned previously. The total number of minutes of moderate exercise was then categorized as a binary variable (yes/no) for engaging in at least 150 minutes of moderate exercise on a weekly basis or meeting recommendations for moderate-intensity physical activity. Existing AF guidelines recommend that patients with AF engage in moderate-intensity physical activity, however do not focus on the duration (time)[11]; we utilized the recommended category, by AHA/ACC guidelines, of moderate exercise in minutes for all apparently healthy adults (at least 150 minutes of moderate exercise).[19]

Clinical and Geriatric Elements

Trained research staff collected data through the conduct of in-person interviews and through the review of participants' medical records. Trained study staff used standard methods to review participants' medical charts and abstract sociodemographic and clinical data including age, sex, race, marital status, and level of education. Clinical factors included body mass index (BMI; overweight, obese, morbidly obese), anticoagulant therapy, type of AF, time since AF diagnosis, calculated stroke and bleeding risk scores, medical history, and relevant laboratory findings.

We used the Cardiovascular Health Survey (CHS) frailty scale to assess frailty among study participants.[20]Gait speed was assessed using the time to walk 15 feet.[21] Social isolation was assessed using the Social Support Scale and Social Network Scale.[22] Participants' cognitive function was assessed using the Montreal Cognitive Assessment Battery (MoCA) with a score≤23 classified as being cognitively impaired.[23] The Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder Scale (GAD7) were used to examine the presence of depressive and anxiety symptoms, respectively.[24,25] Occurrence of falls in the past 6 months, and sensory deficits, including visual and hearing impairments, were self-reported by participants. AF related quality of life was assessed using the Atrial Fibrillation Effect on Quality of Life (AFEQT) questionnaire and OAC treatment satisfaction was assessed using the Anticoagulation Treatment Satisfaction (ACTS) scale.[26,27]

Statistical Analysis

We compared those who met the recommended number of minutes of moderate exercise (≥150 minutes) to those who did not (<150 minutes) according to participants' baseline sociodemographic, clinical, and psychosocial characteristics. We used chi-square tests to examine between group differences for categorical variables and unpaired t-tests for continuous variables.

Logistic regression as used to determine the factors associated with meeting the working definition of moderate exercise. We adjusted for groups of variables based on their clinical relevance as well as their level of significance ($p<0.05$) in their independent association with engagement in moderate physical activity. In Model 1, we examined the association of socio-demographic and clinical variables with participation in moderate exercise. In Mode l 2, we additionally controlled for geriatric elements (i.e., gait speed, falls in past 6 months, cognitive impairment, social isolation, depression, anxiety, and visual

Table 1: Baseline Socio-demographic and Clinical Characteristics of Participants According to Self-Reported Moderate Physical Activity: SAGE-AFStudy

Baseline Characteristics	Moderate Physical Activity		
	Yes (n=652)	No (n=592)	P-value
Socio-demographics			
Age, years, (M, SD)	75 (7)	77 (7)	<0.001
Female (%)	299 (46)	308 (52)	0.03
Married (%)	394 (62)	300 (51)	<0.01
Non-Hispanic White (%)	571 (88)	485 (82)	<0.01
College graduate or more (%)	317 (50)	210 (36)	<0.001
Clinical			
Mean Body Mass Index (kg/m^2) (SD)	29 (6)	31 (7)	<0.001
Body Mass Index (kg/m^2)			
Normal (<25)	133 (20)	113 (19)	<0.001
Overweight (25-29.9)	250 (38)	186 (32)	
Obese (30-39.9)	237 (36)	231 (39)	
Morbidly Obese (≥40)	31 (5)	60 (10)	
Type of AF (%)			
Paroxysmal	403 (62)	338 (57)	0.06
Persistent	157 (24)	152 (26)	
Permanent	28 (4)	45 (8)	
Left Ventricular Ejection Fraction	56 (11)	53 (14)	<0.01
Time since AF Diagnosis, mean, years (SD)	5 (4)	6 (4)	0.16
On OAC (%)	559 (86)	505 (85%)	0.83
Medical History (%)			
Alcohol Use	227 (35)	157 (27)	<0.01
Anemia	186 (29)	205 (35)	<0.01
Asthma/COPD	141 (22)	175 (30)	<0.01
Diabetes	156 (24)	190 (32)	<0.01
Heart Failure	192 (29)	271 (46)	<0.001
Hypertension	576 (88)	546 (92)	0.02
Major Bleeding	118 (18)	126 (21)	0.16
Myocardial Infarction	107 (16)	135 (23)	<0.01
Peripheral vascular disease	76 (12)	103 (17)	<0.01
Renal Disease	146 (22)	210 (35)	<0.001
Stroke/TIA	52 (8)	70 (12)	0.03
Hemoglobin	13 (2)	13 (2)	<0.01
Risk Scores (M, SD)			
CHA_2DS_2-VASc	4 (2)	5 (2)	<0.001
HAS-BLED	3 (1)	3 (1)	<0.01

Abbreviations; DOAC: Direct Oral Anticoagulant; TIA: Transient Ischemic Attack; COPD: Chronic Obstructive Pulmonary Disease; CHA2DS2-VASc: Stroke risk assessment; HAS-BLED: Bleeding risk assessment

impairment) that may influence meeting the recommended minutes of moderate exercise. In Model 3, we further controlled for a patient reported element, namely AFEQT. All statistical analyses were conducted using SAS v 9.4 (SAS Institute Inc., Cary, NC, USA).

Results

A total of 1,244 participants were included in this study. Participants were on average 76 years old, nearly half were women, and three-fifths did not graduate from college. The average body mass index of participants was 30 kg/m2. Approximately 14 % of the study sample were frail and 60 % had paroxysmal AF. Slightly over one-half of study participants (52%) engaged in moderate-intensity physical activity.

Factors Associated with Moderate Physical Activity

Women, those who were obese and morbidly obese, and those who had a history of anemia, asthma/COPD, diabetes, heart failure, hypertension, myocardial infarction, peripheral vascular disease, and renal disease were less likely to meet the recommended level of physical activity than respective comparison groups (Table 1). In addition, participants who were cognitively impaired, were socially isolated, had symptoms of anxiety and depression, experienced a fall in the past 6 months, were visually impaired, current smokers, and those with a lower AFEQT score were less likely to meet the working definition of moderate exercise than respective comparison groups(Table 2).

On the other hand, married participants, non-Hispanic whites, those with a college degree or higher, participants with a history of alcohol use and stroke/TIA, and those that were robust (not frail) and had a normal gait speed were more likely to engage in moderate-intensity physical activity (Tables 1and 2).

In our fully adjusted regression models, morbidly obese participants were 60 % less likely than participants with a normal BMI to engage in moderate activity (Table 3; adjusted OR [aOR]= 0.41; 95% CI= 0.23-0.73). Participants with slow gait speed (aOR= 0.44; 95% CI= 0.32-0.60),a medical history of renal disease(aOR= 0.68,90% CI= 0.48-0.96), who were cognitively impaired (aOR=0.74; 95% CI= 0.56-0.97), and participants with low social support (aOR=0.58; 95% CI= 0.40-0.84)were significantly less likely to meet the recommended level of physical activity than respective comparison group after adjusting for other potentially confounding variables (Table 3).Participants with a high AF related quality of life (AFEQT score >80) were two-thirds more likely to meet the recommended level of physical activity after adjusting for other covariates (Table 3).

Discussion

In our large cohort of older adults with NVAF, slightly more than one-half met current recommendations for participation in moderate physical activity. We showed that morbid obesity, slow gait speed, a medical history of renal disease, cognitive impairment, and social isolation were associated with a lower likelihood of engaging in moderate-intensity physical activity, while participants with a higher health related quality of life were more likely to meet these recommendations.

Extent of Engagement in Moderate Physical Activity

In our cohort, nearly half of older adults with AF reported that they did not engage in moderate-intensity physical activity. We postulate that patients' inability to engage in activity may be playing an important role with failing to meet these recommendations. SAGE-AF participants are older adults with a number and variety of comorbidities who may not have yet adapted to their condition and may be discouraged or reluctant to engage in various physical activities. In a study assessing quality of life among 161 patients with

Table 2: Baseline Psychosocial, Geriatric, and Patient Reported Characteristics ofParticipants According to Self-Reported Moderate Physical Activity: SAGE-AF Study

Baseline Characteristics	Moderate Physical Activity		
	Yes (n=652)	No (n=592)	P-value
Psychosocial and Geriatric			
Gait Speed (%)			
Normal	539 (83)	347 (59)	<0.001
Slow	111 (17)	245 (41)	
Frailty (%)			
Notfrail	391 (60)	22 (4)	<0.001
Pre-frail	248 (38)	411 (69)	
Frail	13 (2)	159 (27)	
Cognitive Impairment (MOCA≤23) (%)	229 (35)	299 (51)	<0.001
Social Isolation (%)	60 (9)	96 (16)	<0.001
Depression (PHQ9 ≥ 5) (%)	143 (22)	210 (36)	<0.001
Anxiety (GAD-7 ≥5) (%)	131 (20)	160 (27)	<0.01
Fall in Past 6 months (%)	126 (19)	144 (24)	0.03
Sensory Deficits (%)			
Visual Impairment	193 (30)	235 (40)	<0.001
Hearing Impairment	243 (37)	208 (35)	0.45
Patient Reported Outcomes			
AFEQT			
Score (M, SD)	84 (16)	76 (19)	<0.001
ACTS (M, SD)			
Burden Score	17 (6)	17 (6)	0.76
Benefit Score	11 (4)	10 (4)	<0.001
TTR (warfarin), mean, time (SD)	0.5 (0.4)	0.5 (0.4)	0.34
Health Behavior			
Current smoker (%)	15 (2)	20 (3)	0.14

Abbreviations; MOCA: Montreal Cognitive Assessment; PHQ9: Patient Health Questionnaire 9; GAD7: Generalized Anxiety Disorder; AFEQT: Atrial Fibrillation Effect on Quality of Life; ACTS: Anticoagulation Treatment Satisfaction; TTR: Time in Therapeutic Range

AF, approximately 90 % indicated that their condition affected their ability to perform regular daily activities.[28] In addition, patients with AF maybe misinformed about their ability to exercise, or even the guideline recommendations of engaging in moderate-intensity physical exercise and avoidance of chronic excess endurance exercise[11]. Older adults with AF may also lack information about how to be physically active while coping with other comorbidities, which may explain the large proportion of individuals in the present study who failed to report regular engagement in moderate physical activity. Therefore, healthcare providers should develop tailored interventions to improve the extent of engagement in moderate physical activity.

Factors Associated with Moderate Physical Activity

To the best of our knowledge, no previous study has examined factors associated with moderate physical activity among older adults with AF. In our study, morbidly obese participants with NVAF were less likely to engage in moderate-intensity physical activity than participants with a normal BMI. Prior studies in healthy individuals have shown that the higher the BMI, the greater the limitation in physical activity observed.[29,30] In addition, due to the various complications of obesity, including in spiratory muscle fatigue and restrictive ventilation, exercise can be very difficult in severely obese patients.[31-34] Therefore, clinicians need to play a crucial role in encouraging morbidly obese patients with AF to engage in some form of physical activity which would also result in the further benefit of weight loss in this high-risk population.

Slow gait speed and social isolation were associated with a lower likelihood of participating in moderate physical activity. Both gait speed and social isolation have been shown to be associated with longer time spent being sedentary, loss of capacity for daily living activities, and reduced time spent in objective physical activity.[35,36] It has been previously shown that healthy adults with high walking speed were more likely to meet recommended levels of physical exercise.[35] Also, interpersonal interactions and social participation were independently associated with physical performance among older adults. Social disengagement and decrease interpersonal interactions were associated with poor physical performance[37]. Health care providers should encourage social engagement and interpersonal interactions through participation in community fitness programs, such as group walks in neighborhoods, and in peer-delivered physical activity interventions which has been shown to increase physical activity behavior.[38]

In the present study, participants who were cognitively impaired were less likely to meet current recommendations for moderate exercise. We postulate that physicians may be more skeptical to engage cognitively impaired adults in their treatment as well as inform them about the importance of incorporating regular moderate exercise into their daily routines.

Participants with a medical history of renal disease were associated with a lower likelihood of participating in moderate exercise. In fact, reduced physical activity and sedentary lifestyle are common in patients with renal disease.[39] Due to the strikingly low physical activity among patients with chronic kidney disease (CKD),[40] detailed exercise guidelines for CKD patients have been published. Patients with CKD are recommended to engage in specific types of exercise and structured activities including strength, flexibility, and aerobic activities. [41] Health care providers should encourage AF patients with CKD to engage in these structured activities to the extent of meeting the recommended intensity of moderate physical activity.

Our study also showed that participants with high AF related quality of life were more likely to report being engaged in moderate activity than those with a low AF related quality of life. Indeed, in the prior study of 161 patients with symptomatic AF, improvement of AF-related symptoms and quality of life improved the physical health index among those who underwent catheter ablation [28]

Our findings have clinical relevance in managing older adults with AF. Since only one-half of older adults with AF reported participating in moderate exercise, health care providers need to encourage patients to partake in regular physical activity and inform them about the health benefits this may provide. In addition, health care providers should identify any physical function or social barriers, including obesity and social isolation, that may hinder meeting the recommended levels of physical activity. Identifying and addressing these "modifiable" factors may help in increasing the proportion of

Table 3: Factors Associated with Self-Reported Moderate Physical Activity: SAGE-AFStudy

	Model 1 Adjusted OR (95 % CI)	Model 2 Adjusted OR (95 % CI)	Model 3 Adjusted OR (95 % CI)
Socio-demographic			
Age (yrs)			
65-74	Ref.	Ref.	Ref.
75-84	0.71 (0.51, 0.97)	0.74 (0.53, 1.03)	0.73 (0.52, 1.02)
85+	0.51 (0.33, 0.79)	0.66 (0.42, 1.05)	0.63 (0.40, 1.00)
Sex (Female vs Male)	0.81 (0.60, 1.10)	0.88 (0.64, 1.21)	0.91 (0.66, 1.25)
Married (No vs Yes)	0.89 (0.69, 1.16)	0.97 (0.74, 1.27)	0.97 (0.74, 1.28)
Non-Hispanic White (Yes vs No)	1.25 (0.88, 1.78)	0.92 (0.63, 1.34)	0.90 (0.61, 1.32)
College Graduate (Yes vs No)	1.36 (1.06, 1.74)	1.19 (0.92, 1.55)	1.16 (0.89, 1.51)
Clinical			
Body Mass Index (BMI), kg/m²			
Normal	Ref.	Ref.	Ref.
Overweight	0.90 (0.64, 1.27)	0.88 (0.62, 1.25)	0.86 (0.60, 1.23)
Obese	0.72 (0.51, 1.02)	0.70 (0.49, 1.00)	0.71 (0.50, 1.02)
Morbidly Obese	0.35 (0.20, 0.61)	0.39 (0.22, 0.70)	0.41 (0.23, 0.73)
Type of AF (%)			
Paroxysmal	Ref.	Ref.	Ref.
Persistent	0.98 (0.73, 1.31)	0.99 (0.74, 1.34)	1.04 (0.77, 1.30)
Permanent	0.69 (0.41, 1.17)	0.61 (0.36, 1.04)	0.65 (0.38, 1.11)
Medical History			
Alcohol Use	1.32 (0.97, 1.78)	1.16 (0.85, 1.59)	1.12 (0.81, 1.54)
Anemia	1.03 (0.78, 1.35)	1.08 (0.82, 1.44)	1.07 (0.81, 1.42)
Asthma/COPD	0.82 (0.62, 1.10)	0.86 (0.64, 1.16)	0.91 (0.67, 1.22)
Diabetes	0.95 (0.69, 1.31)	1.01 (0.72, 1.41)	0.99 (0.71, 1.38)
Heart Failure	0.69 (0.51, 0.94)	0.79 (0.57, 1.09)	0.83 (0.60, 1.15)
Hypertension	0.91 (0.60, 1.39)	0.99 (0.63, 1.53)	0.95 (0.61, 1.48)
Myocardial Infarction	0.78 (0.55, 1.10)	0.73 (0.51, 1.04)	0.72 (0.51, 1.03)
Peripheral vascular disease	0.78 (0.54, 1.14)	0.79 (0.53, 1.16)	0.78 (0.53, 1.14)
Renal Disease	0.76 (0.54, 1.06)	0.71 (0.50, 1.00)	0.68 (0.48, 0.96)
Stroke/TIA	0.78 (0.48, 1.25)	0.83 (0.50, 1.35)	0.78 (0.48, 1.29)
Risk Scores			
CHA_2DS_2-VASc	1.05 (0.90, 1.22)	1.08 (0.92, 1.27)	1.09 (0.93, 1.28)
HAS-BLED	0.94 (0.79, 1.11)	0.98 (0.82, 1.17)	1.00 (0.84, 1.20)
Geriatric Elements			
Gait Speed			
Normal		Ref.	Ref.
Slow		0.45 (0.33, 0.61)	0.44 (0.32, 0.60)
Cognitive Impairment (MOCA)		0.75 (0.57, 0.99)	0.74 (0.56, 0.97)
Social Isolation		0.55 (0.38, 0.81)	0.58 (0.40, 0.84)
Depression (PHQ-9 ≥ 5)		0.68 (0.49, 0.94)	0.76 (0.55, 1.05)
Anxiety (GAD-7 ≥5)		0.85 (0.61, 1.20)	0.93 (0.66, 1.31)
Fall in the Past 6 months		0.92 (0.68, 1.24)	0.96 (0.71, 1.30)
Visual Impairment		0.82 (0.63, 1.07)	0.85 (0.65, 1.12)
Patient Reported Outcome			
AFEQT >80			1.64 (1.25, 2.16)

Model 1: Adjusting for sociodemographic and clinical factors and smoking status; Model 2: M1 + Geriatric Elements; Model 3: Model 1 + Model 2 + patient reported outcomes; Abbreviations:TIA: Transient Ischemic Attack; CHA2DS2-VASc: Stroke risk assessment; HAS-BLED: Bleeding risk assessment; MOCA: Montreal Cognitive Assessment; PHQ-9: Patient Health Questionnaire 9; GAD-7: Generalized Anxiety Disorder; AFEQT: Atrial Fibrillation Effect on Quality of Life.

those engaging in moderate exercise. Lifestyle counseling, including risk factor modification, and patient-centered communication should also be the focus of health care providers in order to improve engagement among older adults with AF.

Study Strengths and Limitations

Our study has several strengths and limitations. First, we included a large and diverse cohort of older adults with NVAF. Second, this study is unique in examining the impact of various geriatric elements, as well as patient reported elements such as AFEQT,that may influence physical activity. Third, we used the Minnesota Leisure Time Physical Activity (LTPA) Questionnaire, a validated questionnaire, to assess physical activity. Alimitation of the present study, however, is that physical activity was self-reported. Subjective methods of physical activity assessments among healthy adults tend to overestimate actual participation in physical activity compared with objective methods of assessment[42] In addition, our study participants are mostly non-Hispanic whites which limits the generalizability of our findings to other study populations. Finally, no causal inferences can be made, and we cannot determine the directionality of the associations since this analysis was cross-sectional in design.

Conclusions

A considerable proportion of older adults with NVAF did not report being engaged in moderate physical activity. Participants who were morbidly obese, cognitively impaired, had a slow gait speed, had a medical history of renal disease, and were socially isolated were less likely, while those with a higher AFEQT score were more likely, to meet these activity recommendations. Our findings provide information for healthcare providers to assessfactors that influence the engagement of older men and women with NVAF in moderate - intensity physical activity and reinforces the need for sustained efforts by healthcare providers to ensure better engagement of their older patients in regular moderate-intensity physical activity which may reduce patient's symptoms of AF and improve their quality of life.

References

1. Chugh SS, Havmoeller R, Narayanan K, Singh D, Rienstra M, Benjamin EJ, Gillum RF, Kim YH, McAnulty JH, Zheng ZJ, Forouzanfar MH, Naghavi M, Mensah GA, Ezzati M, Murray CJL. Worldwide epidemiology of atrial fibrillation: A global burden of disease 2010 study. Circulation2014;129:837–847.
2. Benjamin EJ, Wolf PA, D'Agostino RB, Silbershatz H, Kannel WB, Levy D. Impact of atrial fibrillation on the risk of death: The Framingham Heart Study. Circulation1998;98:946–952.
3. Miyasaka Y, Barnes ME, Bailey KR, Cha SS, Gersh BJ, Seward JB, Tsang TSM. Mortality Trends in Patients Diagnosed With First Atrial Fibrillation. A 21-Year Community-Based Study. J Am Coll Cardiol2007;49:986–992.
4. Lubitz SA, Moser C, Sullivan L, Rienstra M, Fontes JD, Villalon ML, Pai M, McManus DD, Schnabel RB, Magnani JW, Yin X, Levy D, Pencina MJ, Larson MG, Ellinor PT, Benjamin EJ. Atrial fibrillation patterns and risks of subsequent stroke, heart failure, or death in the community. J Am Heart Assoc2013;2:1–9.
5. Wang TJ, Larson MG, Levy D, Vasan RS, Leip EP, Wolf PA, D'Agostino RB, Murabito JM, Kannel WB, Benjamin EJ. Temporal relations of atrial fibrillation and congestive heart failure and their joint influence on mortality: The Framingham heart study. Circulation2003;107:2920–2925.
6. Dorian P, Jung W, Newman D, Paquette M, Wood K, Ayers GM, Camm J, Akhtar

M, Luderitz B. The impairment of health-related quality of life in patients with intermittent atrial fibrillation: Implications for the assessment of investigational therapy. J Am Coll Cardiol2000;36:1303–1309. Available at: http://dx.doi.org/10.1016/S0735-1097(00)00886-X.

7. Jacobs V, Cutler MJ, Day JD, Bunch TJ. Atrial fibrillation and dementia. Trends Cardiovasc Med2015;25:44–51.
8. Chung MK, Eckhardt LL, Chen LY, et al. Lifestyle and Risk Factor Modification for Reduction of Atrial Fibrillation: A Scientific Statement from the American Heart Association. Circulation 2020;141:E750-E772.
9. Gillison FB, Skevington SM, Sato A, Standage M, Evangelidou S. The effects of exercise interventions on quality of life in clinical and healthy populations: a meta-analysis. Soc Sci Med 2009;68:1700–1710.
10. McAuley E, Elavsky S. Physical activity, aging, and quality of life: implications for measurement. Measurement issues in aging and physical activity. Champaign: Human Kinetics 2005; 57–68.
11. Hindricks G, Potpara T, Dagres N, Arbelo E, Bax JJ, Blomström-Lundqvist C, Boriani G, Castella M, Dan G-A, Dilaveris PE, Fauchier L, Filippatos G, Kalman JM, Meir M La, Lane DA, Lebeau J-P, Lettino M, Lip GYH, Pinto FJ, Thomas GN, Valgimigli M, Gelder IC Van, Putte BP Van, Watkins CL, Kirchhof P, Kühne M, Aboyans V, Ahlsson A, Balsam P, Bauersachs J, Benussi S, Brandes A, Braunschweig F, Camm AJ, Capodanno D, Casadei B, Conen D, Crijns HJGM, Delgado V, Dobrev D, Drexel H, Eckardt L, Fitzsimons D, Folliguet T, Gale CP, Gorenek B, Haeusler KG, Heidbuchel H, Iung B, Katus HA, et al. 2020 ESC Guidelines for the diagnosis and management of atrial fibrillation developed in collaboration with the European Association of Cardio-Thoracic Surgery (EACTS). Eur Heart J 2020:1–126.
12. Garnvik LE, Malmo V, Janszky I, Ellekjær H, Wisløff U, Loennechen JP, Nes BM. Physical activity, cardiorespiratory fitness, and cardiovascular outcomes in individuals with atrial fibrillation: The HUNT study. Eur Heart J2020;41:1467–1475.
13. Giacomantonio NB, Bredin SS, Foulds HJ, Warburton DE. A systematic review of the health benefits of exercise rehabilitation in persons living with atrial fibrillation. Can J Cardiol. 2013;29:483-491.
14. Saczynski JS, Sanghai SR, Kiefe CI, Lessard D, Marino F, Waring ME, Parish D, Helm R, Sogade F, Goldberg R, Gurwitz J, Wang W, Mailhot T, Bamgbade B, Barton B, McManus DD. Geriatric Elements and Oral Anticoagulant Prescribing in Older Atrial Fibrillation Patients: SAGE-AF. J Am Geriatr Soc2020;68:147–154.
15. Wang W, Saczynski J, Lessard D, et al. Physical, cognitive, and psychosocial conditions in relation to anticoagulation satisfaction among elderly adults with atrial fibrillation: The SAGE-AF study. J Cardiovasc Electrophysiol. 2019;30:2508-2515.
16. Odum LE, Cochran KA, Aistrope DS, Snella KA. The $CHADS_2$versus the new CHA2DS2-VASc scoring systems for guiding antithrombotic treatment of patients with atrial fibrillation: review of the literature and recommendations for use. Pharmacotherapy. 2012;32:285-296.
17. Elosua R, Marrugat J, Molina L, Pons S, Pujol E. Validation of the Minnesota Leisure Time Physical Activity Questionnaire in Spanish men. The MARATHOM Investigators. Am J Epidemiol. 1994;139:1197-1209.
18. Elosua R, Garcia M, Aguilar A, Molina L, Covas M-I, Marrugat J. Validation of the Minnesota Leisure Time Spanish Women. Med Sci Sport Exerc2000;32:1431–1437.
19. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, Michos ED, Miedema MD, Muñoz D, Smith SC, Virani SS, Williams KA, Yeboah J, Ziaeian B. 2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.; 2019.
20. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, McBurnie MA. Frailty in older adults: Evidence for a phenotype. Journals Gerontol - Ser A Biol Sci Med Sci2001;56:146–157.
21. Green P, Woglom AE, Genereux P, Maurer MS, Kirtane AJ, Hawkey M, Schnell S, Sohn J, Moses JW, Leon MB, Smith CR, Williams M, Kodali S. Gait speed and dependence in activities of daily living in older adults with severe aortic stenosis. Clin Cardiol2012;35:307–314.
22. Sherbourne CD, Stewart AL. The MOS social support survey. Soc Sci Med1991;32:705–714.
23. Nasreddine ZS, Phillips NA, Bedirian V, CharbonS,Whitehead V, Collin I, Cummings JL, Chertkow H. The montreal cognitive assessment, MoCA: A brief screening tool for mild cognitive impairment. Journal of American Geriatrics Society 2005; 53:695-699.
24. Spertus J, Dorian P, Bubien R, Lewis S, Godejohn D, Reynolds MR, Lakkireddy DR, Wimmer AP, Bhandari A, Burk C. Development and validation of the Atrial Fibrillation Effect on QualiTy-of-life (AFEQT) questionnaire in patients with Atrial Fibrillation. Circ Arrhythmia Electrophysiol2011;4:15–25.
25. Cano SJ, Lamping DL, Bamber L, Smith S. The Anti-Clot Treatment Scale (ACTS) in clinical trials: cross-cultural validation in venous thromboembolism patients. Health Qual Life Outcomes2012;10:1. Available at: Health and Quality of Life Outcomes.
26. Bubien RS, Knotts-Dolson SM, Plumb VJ, Kay GN. Effect of Radiofrequency Catheter Ablation on Health-Related Quality of Life and Activities of Daily Living in Patients With Recurrent Arrhythmias. Circulation. 1996;94:1585-1591. doi:10.1161/01.CIR.94.7.1585
27. Hassan MK, Joshi A V., Madhavan SS, Amonkar MM. Obesity and health-related quality of life: A cross-sectional analysis of the US population. Int J Obes2003;27:1227–1232.
28. Wang J, Sereika SM, Styn MA, Burke LE. Factors associated with health-related quality of life among overweight or obese adults. J Clin Nurs2013;22:2172–2182.
29. Stewart AL, Brook RH. Effects of being overweight. Am J Public Health1983;73:171–178.
30. Chlif M, Keochkerian D, Feki Y, Vaidie A, Choquet D, Ahmaidi S. Inspiratory muscle activity during incremental exercise in obese men. Int J Obes2007;31:1456–1463.
31. Chlif M, Keochkerian D, Mourlhon C, Choquet D, Ahmaidi S. Noninvasive assessment of the tension-time index of inspiratory muscles at rest in obese male subjects. Int J Obes2005;29:1478–1483.
32. Sood A. Altered Resting and Exercise Respiratory Physiology in Obesity. Clin Chest Med2009;30:445–454.
33. Ciprandi D, Bertozzi F, Zago M, Ferreira CLP, Boari G, Sforza C, Galvani C. Study of the association between gait variability and physical activity. Eur Rev Aging Phys Act2017;14:1–10.
34. Schrempft S, Jackowska M, Hamer M, Steptoe A. Associations between social isolation, loneliness, and objective physical activity in older men and women. BMC Public Health2019;19:1–10.
35. Philip KEJ, Polkey MI, Hopkinson NS, Steptoe A, Fancourt D. Social isolation, loneliness and physical performance in older-adults: fixed effects analyses of a cohort study. Sci Rep2020;10:1–9. Available at: https://doi.org/10.1038/s41598-020-70483-3.
36. Ginis KAM, Nigg CR, Smith AL. Peer-delivered physical activity interventions: An overlooked opportunity for physical activity promotion. TranslBehav Med2013;3:434–443.
37. Mallamaci F, Pisano A, Tripepi G. Physical activity in chronic kidney disease

and the EXerCise Introduction to Enhance trial. Nephrol Dial Transplant 2020;35:II18–II22.3.

38. Aucella F, Valente GL, Catizone L. The role of physical activity in the CKD setting. Kidney Blood Press Res2014;39:97–106.
39. Milam RH. Exercise guidelines for chronic kidney disease patients. J Ren Nutr 2016;26:e23–e25. Available at: http://dx.doi.org/10.1053/j.jrn.2016.03.001.
40. Pawar S, G. PP, Kharche JS, Ashok P. Correlation of subjective and objective measurement of physical activity in young adult and assessment of general awareness of type 2 Diabetes mellitus in Pune urban population. Int J Adv Med2017;4:1064.

JAFIB®

Editorial

Journal of Atrial Fibrillation

www. jafib.com

Physical Inactivity Among Older Adults with Atrial Fibrillation: Prime Time to Get Active!

Sharma Kattel[1], Rachel Lampert[1]

[1] *Division of Cardiovascular Medicine, Yale School of Medicine New Haven, CT*

Editorial

Atrial fibrillation (AF) affects more than 3 million Americans, with estimated prevalence of nearly 10% in 65 years and older[1]. The prevalence of the disease increases steeplyin the elderly, affecting nearly 12% in 75–84 years, and approximately 1/3 in 80 years or older. The current estimated global burden of the disease is more than 33.5 million[2]. With increasing disease incidence by approximately 5 million each year worldwide, there is urgent need to identify and address associated risk factors [3]. In the recent CABANA trial, with over 2100 patients, the median Atrial Fibrillation Effect on Quality of Life (AFEQT) score was just 63 (Interquartile 25-75%: 48-80) suggesting more than 75% of the patients were moderate to severely symptomatic affecting their quality of life[4]. The toll of AF in overall health and quality of life that it poses cannot be overemphasized.

Over the last two decades, our understanding on AF has much advanced and a number of risk factors have been identified[1,5]. While some risk factors are non-modifiable such as age, male gender, single or polygenic (heritable or de-novo) inheritance, important modifiable risk factors have also been identified. In addition to metabolic syndrome, obesity, sleep apnea, hypertension, chronic kidney disease, diabetes mellitus, cigarette smoking, and depression, physical inactivity has been identified among the most potent modifiable risk factor[1,6]. In a CARDIO-FIT study, Pathak et al have shown that a tailored exercise program designed for age and physical ability involving combination of aerobic and resistance/strength exercises for progressive fitness, every METs gained from baseline was associated with 9% decline in risk of AF recurrence[7]. Hence the role of risk factors management including structured moderate physical activity and weight loss cannot be over stated.

In this issue of JAFIB, Mehawej, J et al report onfactors associated with lower levels of moderate intensity physical activity in acohort of elderly patients.Assessing physical activity in real life is challenging as it is associated with inaccuracies and often exaggerated due to recall bias. A strength of the study is the use of the Minnesota Leisure Time Physical Activity questionnaireto assess the level of physical activity[8]. This instrument has been validated and correlates positivelywith level of cardiorespiratory fitness[9].The use of the Cardiovascular Health Study frailty scale is another strength of the study. This instrument was developed based on the Cardiovascular Health Study, where frailty phenotype (defined as presence of ≥ 3: unintentional weight loss, self-reported exhaustion, weakness, slow walking speed and low physical activity) was independently predictive of incident falls, worsening mobility, hospitalization and deaths (adjusted HR: 1.29–2.24)[10]. Depending on the tool of assessment, prevalence of frailty has been described in up to 75% of the elderly patients with AF[11]. Evaluating frailty in patients with AF is important as it has been associated with increased mortality, higher symptom burden, poor success to ablation therapies, and higher incidence of bleeding on oral anticoagulation[11,12].

Another strength of this study is the gender makeup of the population, withnearly 50% of the study participants being women.While the age adjusted prevalence of AF in US has been reported to be 0.9% in females compared to 2.4% in male, female gender has been underrepresented in the majority of major clinical trials[13]. In theCABANA trial assessing the effect of catheter ablation vs medical therapy on quality of life in AF patients, only 37% of the subjects were female[4]. Similarly, in the HUNT study,assessing the physical activity and cardiovascular outcome in AF patients, only 31% were females[14]. The Cardiovascular Health Study whichassessed the physical activity and incidence of AF in older adults had better female participation, about 56%. In that study women had lower rate of participation in recommended physical activity and were older compared to males[14,15]. It is important to highlight that the level of physical activity can have gender specific impacts on outcome. In a recent meta-analysis, women were shown to benefit from all level of physical activities, whereas in males, up to moderate physical activity was beneficial but vigorous activities were associated with higher incidence of AF[16].

Corresponding Author:
Rachel Lampert, MD
Yale School of Medicine,
New Haven, CT.

As in most trials, African American, Asian American and Hispanics are underrepresented in this study also. With little data, the true incidence and prevalence of the disease in these population is hard to ascertain. Despite higher prevalence of known risk factors as hypertension, obesity, diabetes in African Americans and Hispanics, the incidence of AF may be lower in these population although these populations are underrepresented in majority of trials and population-based studies[1]. In The Cardiovascular Health Study assessing physical activity and incidence of AF in older population, only 17% of the participants were nonwhite15. Even in the Multiethnic Study of Atherosclerosis (MESA), only 42.9% of the participants were non-white highlighting the disparity in representing these population, with AF incidence of 3.4% over a median follow-up of 5.3 years[17].

Too many Americans are sedentary. In a Center for Disease Control (CDC) survey from 2014, nearly 27% of individuals between ages 65-74 years old and nearly 35% aged ≥75 years old were physically inactive or reported no physical activity outside of their work18. In current study by Mehawej, J et al, the results are even more sobering as nearly 50% of the adults above 65 years are engaged in less than the recommended physical activity. Regardless, both of these studies highlight the importance of exercise as a readily available tool that is highly effective in improving AF outcomes yetis much underutilized. In the same CDC survey, as the number of chronic diseases, identified as stroke, coronary heart disease, arthritis, cancer (excluding skin cancer), chronic obstructive pulmonary disease (COPD) and depression burden increased, the level of physical activity was more limited[18]. Besides the CDC identified risk factors for reduced physical activity in elderly population, the investigators have identified factors pertaining to elderly AF patients that includes morbid obesity, renal disease, slow gait speed, cognitive impairment and social isolation.

As in any cross-sectional study, it is a limitation that direction ofcause-and-effectcannot be determined and relationships may be complex. Obesity has been associated with poor self-esteem, depression, and social isolation which in turn likely limit the much-needed physical activity in these patients and perpetuate obesity and its related complications[19]. On the other hand, there is increasing evidence that depression and physical inactivity interact in both directions leading to poor cardiovascular health outcomes[20].

This study has clearly identify that physical inactivity is rampant in elderly patients with AF. How to improve this?In patients with multiple forms of cardiovascular disease including acute myocardial infraction, congestive heart failure, coronary artery bypass and open-heart surgery, cardiac rehabilitation programs with graded exercise are safe and effective. A number of smaller studies have showncardiac rehabilitation in patient with AF is also safe and effective in improving cardiovascular outcomes[7,21,22]. Asevidence builds of the safety and efficacy of moderate intensity physical activity in patients withAF, it is prime time to institute it in our practice. Increasing awareness of potential benefits of physical activity in this population is critical. Adults who remain physically activein their mid-life are likely to remain active and have better health outcomes later in their life so promoting these activities in early or mid-adulthood will have a lasting impact in our growing elderly population[23]. As shown by Pathak R et al, aggressive risk factors reduction such as weight loss, moderate intensity physical activity, blood pressure, lipid and sleep disorder managementwereassociated with long term arrhythmia free survival[24]. Programs designed to engage individuals at community level such as community fitness programs, peer delivered physical activity, neighborhood group walks programs can be effective to encourage physical activity and break social isolation to improve cardiovascular health outcomes[25,26]. Also, similar programs to increase awareness and incorporateroutine scheduled physical activities in long term care facilities can benefit substantial elders as approximately 6% of the US population get help or live in some form of assisted or long-term care facilities.

It has been reported that excessive endurance activities can lead to increased incidence of AF. But how much should we be concerned about urging increasing activity, given the evidence that "excessive endurance exercise" can worsen AF? In Finnish veteran orienteers with history ofhigh endurance activity (an average military training history of 36 years),the incidence of lone AF was 5.3% compared to control of 0.9%and those between the age of 63-70 years had anincidence of 6.6%[27]. In a study of elderly Norwegian men between the age of 65-90 years with history of long-term endurance sport (average 33 years of systematic endurance training, in average competed 17cross-county ski races)had 6% (95% CI: 0.8-11.1) added risk compared to general population of the similar age group[28]. These vigorous activities included long range cycling, marathon running and high endurance sports, are not applicable to most of our elderly patients[29]. Several studies have shown a U-shaped response with the intensity of physical activity and increased risk of AF when cumulative hours of vigorous endurance sports activity are >1500-2000 hours or >5 hours per week[30-32]. Very few elderly patients areengaging in these high levels of endurance activity. While recognizing this impact is important for the tiny minority of AF patients who run marathons or involve in high endurance activity, for the vast majority of our patients, helping them get off the couch and get moving is one of the most important interventions we can offer.

References

1. January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC, Jr., Conti JB, Ellinor PT, Ezekowitz MD, Field ME, Murray KT, Sacco RL, Stevenson WG, Tchou PJ, Tracy CM, Yancy CW. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. Journal of the American College of Cardiology 2014;64:e1-76.
2. Chugh SS, Havmoeller R, Narayanan K, Singh D, Rienstra M, Benjamin EJ, Gillum RF, Kim YH, McAnulty JH, Jr., Zheng ZJ, Forouzanfar MH, Naghavi M, Mensah GA, Ezzati M, Murray CJ. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation 2014;129:837-847.
3. Alonso A, Bengtson LG. A rising tide: the global epidemic of atrial fibrillation. Circulation 2014;129:829-830.
4. Mark DB, Anstrom KJ, Sheng S, Piccini JP, Baloch KN, Monahan KH, Daniels MR, Bahnson TD, Poole JE, Rosenberg Y, Lee KL, Packer DL. Effect of Catheter Ablation vs Medical Therapy on Quality of Life Among Patients With Atrial Fibrillation: The CABANA Randomized Clinical Trial. JAMA : the journal of the American Medical Association 2019;321:1275-1285.
5. Williams BA, Chamberlain AM, Blankenship JC, Hylek EM, Voyce S. Trends in

Atrial Fibrillation Incidence Rates Within an Integrated Health Care Delivery System, 2006 to 2018. JAMA Netw Open 2020;3:e2014874.
6. Kennedy HL. Silent Atrial Fibrillation: Definition, Clarification, and Unanswered Issues. Ann Noninvasive Electrocardiol 2015;20:518-525.
7. Pathak RK, Elliott A, Middeldorp ME, Meredith M, Mehta AB, Mahajan R, Hendriks JM, Twomey D, Kalman JM, Abhayaratna WP, Lau DH, Sanders P. Impact of CARDIOrespiratory FITness on Arrhythmia Recurrence in Obese Individuals With Atrial Fibrillation: The CARDIO-FIT Study. Journal of the American College of Cardiology 2015;66:985-996.
8. Lamb KL, Brodie DA. The assessment of physical activity by leisure-time physical activity questionnaires. Sports Med 1990;10:159-180.
9. Talbot LA, Metter EJ, Fleg JL. Leisure-time physical activities and their relationship to cardiorespiratory fitness in healthy men and women 18-95 years old. Med Sci Sports Exerc 2000;32:417-425.
10. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, Seeman T, Tracy R, Kop WJ, Burke G, McBurnie MA. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001;56:M146-156.
11. Guo Q, Du X, Ma CS. Atrial fibrillation and frailty. J Geriatr Cardiol 2020;17:105-109.
12. Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. Lancet 2013;381:752-762.
13. Ko D, Rahman F, Schnabel RB, Yin X, Benjamin EJ, Christophersen IE. Atrial fibrillation in women: epidemiology, pathophysiology, presentation, and prognosis. Nat Rev Cardiol 2016;13:321-332.
14. Garnvik LE, Malmo V, Janszky I, Ellekjær H, Wisløff U, Loennechen JP, Nes BM. Physical activity, cardiorespiratory fitness, and cardiovascular outcomes in individuals with atrial fibrillation: the HUNT study. European heart journal 2020;41:1467-1475.
15. Mozaffarian D, Furberg CD, Psaty BM, Siscovick D. Physical activity and incidence of atrial fibrillation in older adults: the cardiovascular health study. Circulation 2008;118:800-807.
16. Mohanty S, Mohanty P, Tamaki M, Natale V, Gianni C, Trivedi C, Gokoglan Y, L DIB, Natale A. Differential Association of Exercise Intensity With Risk of Atrial Fibrillation in Men and Women: Evidence from a Meta-Analysis. Journal of cardiovascular electrophysiology 2016;27:1021-1029.
17. O'Neal WT, Soliman EZ, Qureshi W, Alonso A, Heckbert SR, Herrington D. Sustained pre-hypertensive blood pressure and incident atrial fibrillation: the Multi-Ethnic Study of Atherosclerosis. J Am Soc Hypertens 2015;9:191-196.
18. Watson KB, Carlson SA, Gunn JP, Galuska DA, O'Connor A, Greenlund KJ, Fulton JE. Physical Inactivity Among Adults Aged 50 Years and Older - United States, 2014. MMWR Morb Mortal Wkly Rep 2016;65:954-958.
19. Mannan M, Mamun A, Doi S, Clavarino A. Is there a bi-directional relationship between depression and obesity among adult men and women? Systematic review and bias-adjusted meta analysis. Asian J Psychiatr 2016;21:51-66.
20. Whooley MA, de Jonge P, Vittinghoff E, Otte C, Moos R, Carney RM, Ali S, Dowray S, Na B, Feldman MD, Schiller NB, Browner WS. Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. JAMA : the journal of the American Medical Association 2008;300:2379-2388.
21. Robaye B, Lakiss N, Dumont F, Laruelle C. Atrial fibrillation and cardiac rehabilitation: an overview. Acta Cardiol 2020;75:116-120.
22. Younis A, Shaviv E, Nof E, Israel A, Berkovitch A, Goldenberg I, Glikson M, Klempfner R, Beinart R. The role and outcome of cardiac rehabilitation program in patients with atrial fibrillation. Clin Cardiol 2018;41:1170-1176.
23. McPhee JS, French DP, Jackson D, Nazroo J, Pendleton N, Degens H. Physical activity in older age: perspectives for healthy ageing and frailty. Biogerontology 2016;17:567-580.
24. Pathak RK, Middeldorp ME, Lau DH, Mehta AB, Mahajan R, Twomey D, Alasady M, Hanley L, Antic NA, McEvoy RD, Kalman JM, Abhayaratna WP, Sanders P. Aggressive risk factor reduction study for atrial fibrillation and implications for the outcome of ablation: the ARREST-AF cohort study. Journal of the American College of Cardiology 2014;64:2222-2231.
25. Stathi A, Withall J, Thompson JL, Davis MG, Gray S, De Koning J, Parkhurst G, Lloyd L, Greaves C, Laventure R, Fox KR. Feasibility Trial Evaluation of a Peer Volunteering Active Aging Intervention: ACE (Active, Connected, Engaged). Gerontologist 2020;60:571-582.
26. Crozier A, Porcellato L, Buckley BJR, Watson PM. Facilitators and challenges in delivering a peer-support physical activity intervention for older adults: a qualitative study with multiple stakeholders. BMC Public Health 2020;20:1904.
27. Karjalainen J, Kujala UM, Kaprio J, Sarna S, Viitasalo M. Lone atrial fibrillation in vigorously exercising middle aged men: case-control study. BMJ (Clinical research ed) 1998;316:1784-1785.
28. Myrstad M, Løchen ML, Graff-Iversen S, Gulsvik AK, Thelle DS, Stigum H, Ranhoff AH. Increased risk of atrial fibrillation among elderly Norwegian men with a history of long-term endurance sport practice. Scand J Med Sci Sports 2014;24:e238-244.
29. Centurión OA, Candia JC, Scavenius KE, García LB, Torales JM, Miño LM. The Association Between Atrial Fibrillation and Endurance Physical Activity: How Much is too Much? J Atr Fibrillation 2019;12:2167.
30. Calvo N, Ramos P, Montserrat S, Guasch E, Coll-Vinent B, Domenech M, Bisbal F, Hevia S, Vidorreta S, Borras R, Falces C, Embid C, Montserrat JM, Berruezo A, Coca A, Sitges M, Brugada J, Mont L. Emerging risk factors and the dose-response relationship between physical activity and lone atrial fibrillation: a prospective case-control study. Europace : European pacing, arrhythmias, and cardiac electrophysiology : journal of the working groups on cardiac pacing, arrhythmias, and cardiac cellular electrophysiology of the European Society of Cardiology 2016;18:57-63.
31. Elosua R, Arquer A, Mont L, Sambola A, Molina L, García-Morán E, Brugada J, Marrugat J. Sport practice and the risk of lone atrial fibrillation: a case-control study. Int J Cardiol 2006;108:332-337.
32. Larsson SC, Drca N, Jensen-Urstad M, Wolk A. Combined impact of healthy lifestyle factors on risk of atrial fibrillation: Prospective study in men and women. Int J Cardiol 2016;203:46-49.