

Usefulness of Self-Reported Physical Activity and Clinical Outcomes in Older Patients With Atrial Fibrillation



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Current guidelines encourage regular physical activity (PA) to gain cardiovascular health benefit. However, little is known about whether older adults with atrial fibrillation (AF) who engage in the guideline-recommended level of PA are less likely to experience clinically relevant outcomes. We did a retrospective study based on the data from Systemic Assessment of Geriatric Elements in AF (SAGE-AF) prospective cohort study. The study population consisted of older participants with AF (≥ 65 years) and a congestive heart failure, hypertension, age, diabetes, stroke vascular disease, age 65 to 75 and sex (CHA₂DS₂-VASc) score ≥ 2 . PA was quantified by self-reported Minnesota Leisure Time PA questionnaire. Competing risk models were used to examine the association between PA level and clinical outcomes over 2 years while controlling for several potentially confounding variables. A total of 1,244 participants (average age 76 years; 51% men; 85% non-Hispanic White) were studied. A total of 50.5% of participants engaged in regular PA. Meeting the recommended level of PA was associated with lower mortality over 2 years (adjusted hazard ratio 0.60, 95% confidence interval 0.38 to 0.95) but was not associated with rates of stroke or major bleeding. In conclusion, older adults with AF who engaged in guideline-recommended PA are more likely to survive in the long term. Healthcare providers should promote and encourage engagement in PA and tailor interventions to address barriers of engagement. © 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>) (Am J Cardiol 2022;181:32–37)

Atrial fibrillation (AF) has been recognized as a major risk factor for ischemic stroke^{1,2} and contributes to the development of heart failure, myocardial infarction, and all-cause mortality.³ Exercise has been shown to modify several risk factors that contribute to the development of AF, including reducing body weight, blood pressure, and serum low-density lipoprotein levels.⁴ Current guidelines

recommended at least 150 minutes per week of moderate-intensity physical activity (PA), which also translates as 500 metabolic equivalent task (MET) minutes per week of PA. However, it remains unclear whether the same level of PA would benefit the AF population.⁵ Using data collected from a large prospective study,⁶ we examined the association between guideline-recommended level of PA and major adverse clinical outcomes, including total mortality, stroke, major bleeding, and clinically relevant bleeding in older adults with AF.

Methods

We used data collected in the Systematic Assessment of Geriatric Elements (SAGE)-AF study to perform a retrospective study. SAGE-AF is a prospective study of AF, oral anticoagulation treatment, and relations between comprehensive baseline geriatric assessment. The study started on February 17, 2016 and ended on January 31, 2020.⁶ Eligible study participants included those who were scheduled for an ambulatory care visit at 1 of 4 Central Massachusetts practices (University of Massachusetts Memorial Health Care internal medicine, cardiology, or electrophysiology, Heart Rhythm Associates of Central Massachusetts), 1 practice in Eastern Massachusetts (Boston University cardiology), or 1 of 2 practices in Central Georgia (Family

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Health Center and Georgia Arrhythmia Consultants); and participants with AF (if the arrhythmia was present on an electrocardiogram or Holter monitor or if it was noted in any clinic note or hospital record), who were aged ≥ 65 years and had a congestive heart failure, hypertension, age, diabetes, stroke, vascular disease, age 65 to 75 and sex (CHA₂DS₂-VASc score) ≥ 2 .⁷ Participants who were not eligible for enrollment were those who had documentation of an absolute contraindication to anticoagulation or had an indication for anticoagulation other than AF, were unable to provide signed informed consent, did not speak English, had a planned invasive procedure with high risk for uncontrolled bleeding, or were unwilling or unable to participate in planned 1- and 2-year follow-up visits at their study sites.⁸ The study protocol was approved by the University of Massachusetts Medical School, Boston University, and Mercer University Institutional Review Boards.

Participants' baseline characteristics, including their demographics (i.e., age, gender, race, level of education, marital status), clinical characteristics (i.e., body mass index [BMI], type of AF, time since AF diagnosis, CHA₂DS₂-VASc score, hypertension, abnormal renal/liver function, stroke, bleeding history or predisposition labile international normalized ratio, elderly, drugs/alcohol concomitantly (HAS-BLED) score, previously diagnosed chronic obstructive pulmonary disease, coronary artery disease, diabetes mellitus, heart failure, hypertension, myocardial infarction, peripheral vascular disease, kidney disease and stroke, and smoking status were abstracted from hospital and clinic medical records by trained research staff. Geriatric components, including frailty and symptoms of depression, were measured using the Cardiovascular Health Survey frailty scale,⁹ and Patient Health Questionnaire PHQ-9,¹⁰ respectively.

PA was measured using the Minnesota Leisure Time PA questionnaire at baseline. Participants were asked to report if they performed any of the following activities during the previous 2 weeks: (1) walking at a usual speed for exercise, (2) moderately strenuous household or outdoor chores, (3) indoor activity like dancing or bowling, or (4) any regular activity other than walking. These activities were documented as frequency and duration (in minutes) of each activity participants spent doing. Each type of PA was assigned a MET score based on previously validated energy cost.¹¹ We calculated and combined the MET-minutes per week task on a weekly basis. The total number of MET-minutes per week was then categorized as a binary variable (yes/no) for engaging in at least 500 MET-minutes per week, which is the recommended level of PA based on current guidelines.¹²

Deaths and bleeding events among study participants from hospital medical records and death certificates were adjudicated by a committee of physicians.

Information on the development of bleeding and stroke events was obtained from the review of hospital medical records. The International Society of Thrombosis and Hemostasis scale was used to grade bleeding events.¹³

Major bleeding was defined as any fatal bleeding, symptomatic bleeding in a critical area or organ, or bleeding that resulted in a decrease in hemoglobin of 2 g/100 ml, which led to ≥ 2 units of transfusion.^{13,14}

Clinically relevant bleeding refers to bleeding events that meet the criteria for a major bleeding episode and all cases of bleeding that did not meet our major criteria but involved temporary interruption of anticoagulation, pain (e.g., hematoma), medical intervention (e.g., macroscopic hematuria), an unscheduled contact (visit or telephone) with a physician, or impairment of daily activities (e.g., inability to walk because of a hematoma).¹⁴

Baseline sociodemographic, clinical, and psychosocial characteristics of participants who met versus those who did not meet the recommended level of PA were compared using Wilcoxon test for continuous variables and chi-square tests for categorical variables. Charlson co-morbidity score was calculated based on the weight of each co-morbidity.

The Fine and Gray competing risk models were used to determine if meeting the recommended level of PA was associated with the 4 clinical outcomes examined while controlling for several potentially confounding variables. Variables included in the models were based on their clinical relevance and their level of significance ($p < 0.05$). We adjusted for demographic variables, including age, gender, race, marital status, and education, and clinical co-morbidities, including type of AF, BMI, medical history of chronic obstructive pulmonary disease, coronary artery disease, diabetes, heart failure, hypertension, myocardial infarction, peripheral vascular disease, renal disease, stroke, and symptoms of depression. All statistical analyses were conducted using SAS v 9.4 (SAS Institute Inc., Cary, North Carolina).

Results

A total of 1,244 participants were included in the present study. The average age of study participants was 76 years old, 51.2% were men, and the average BMI of the study population was 30.1 kg/m². Approximately, 60.0% ($n = 741$) of participants had paroxysmal AF. The average CHA₂DS₂-VASc score was 4.4 and the average Charlson co-morbidity score was 6. Half ($n = 616$) of study participants failed to meet the recommended level of PA. After 2 years of follow-up, 108 participants (8.7%) had died, 19 developed stroke (1.5%), 105 had experienced an episode of major bleeding (8.4%), and 382 had an episode of clinically relevant bleeding (30.7%).

Participants who met the recommended level of PA were younger (74 [69 to 79] vs 76 [71 to 82], $p < 0.001$), had lower BMI (BMI: 28.7 [25.7 to 33.0] vs 29.7 [25.8 to 34.1], $p = 0.034$), more likely to be men (55.1% vs 47.2%), non-Hispanic White (87.6% vs 82.3%), were married (62.2% vs 51.1%), had a college degree or higher (50.0% vs 36.3%), and had experienced paroxysmal AF (62.1% vs 57.0%) than those who did not meet the recommended level of PA (Table 1).

Regarding the clinical co-morbidities, participants in the group who met the recommended PA level were less likely to have to have chronic lung disease (22.5% vs 28.4%), coronary artery disease (23.9% vs 32.1%), diabetes mellitus (24.0% vs 31.7%), heart failure (29.0% vs 45.6%), hypertension (88.2% vs 92.2%), myocardial infarction (16.2% vs 22.7%), peripheral vascular disease (12.1% vs 16.7%), kidney disease (22.1% vs 35.2%), stroke (8.0% vs 11.7%), and symptoms of depression (21.7% vs 35.2%)

Table 1
Characteristics of older adults with atrial fibrillation

Variables	MET recommended level of physical activity		p Value
	Yes (n = 628)	No (n = 616)	
Age (median (lower, upper quartile))	74 (69,79)	76 (71,82)	<0.001
Men	346 (55.1%)	291 (47.2%)	0.006
BMI (median (lower, upper quartile)) (kg/m ²)	28.7 (25.7, 33.0)	29.7 (25.8, 34.1)	0.034
Non-Hispanic white	549 (87.6%)	507 (82.3%)	0.010
Married	384 (62.2%)	310 (51.1%)	<0.001
College graduate or higher	308 (50.0%)	219 (36.3%)	<0.001
Type of AF			0.044
Paroxysmal	390 (62.1%)	351 (57.0%)	
Persistent	153 (24.4%)	156 (25.3%)	
Permanent	26 (4.1%)	47 (7.6%)	
Time Since AF diagnosis (years) (median (lower/upper quartile))	4.6 (1.7, 8.2)	4.8 (1.9, 8.2)	0.433
Charlson co-morbidity index (median (lower/upper quartile))	5 (4, 7)	6 (5, 8)	<0.001
Chads2Vasc score (median (lower/upper quartile))	4 (3, 5)	5 (3, 6)	<0.001
HAS-BLED score (median (lower/upper quartile))	3 (2, 4)	3 (3, 4)	0.003
Chronic lung disease	141 (22.5%)	175 (28.4%)	0.016
Coronary artery disease	150 (23.9%)	198 (32.1%)	0.001
Diabetes mellitus	151 (24.0%)	195 (31.7%)	0.003
Heart failure	182 (29.0%)	281 (45.6%)	<0.001
Hypertension	554 (88.2%)	568 (92.2%)	0.018
Myocardial infarction	102 (16.2%)	140 (22.7%)	0.004
Peripheral vascular disease	76 (12.1%)	103 (16.7%)	0.020
Kidney disease	139 (22.1%)	217 (35.2%)	<0.001
Stroke	50 (8.0%)	72 (11.7%)	0.027
Anticoagulation use	538 (85.7%)	526 (85.4%)	0.110
Symptoms of depression	136 (21.7%)	217 (35.2%)	<0.001
Smoking Status			0.303
Never	312 (49.7%)	282 (45.8%)	
Former	301 (47.9%)	314 (51.0%)	
Current	15 (2.4%)	20 (3.3%)	
Provider type			0.060
Internist	21 (3.3%)	9 (1.5%)	
Cardiologist	301 (47.9%)	286 (46.4%)	
Electrophysiologist	306 (48.7%)	321 (52.1%)	

AF = atrial fibrillation; BMI = body mass index.

than the group which did not meet the recommended level of PA (Table 1).

Cumulative incidence curves are shown in Figures 1-4. After adjusting for confounding, patients who met the

recommended guidelines for PA were significantly less likely to have died during the 2-year follow-up (adjusted hazard ratio (HR) [aHR] = 0.60, 95% confidence interval [CI] 0.38 to 0.95; Table 2). In contrast, we did not observe

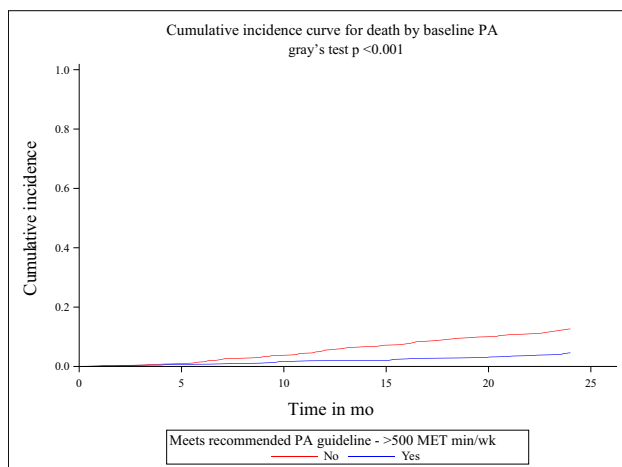


Figure 1. Cumulative incidence curve for mortality.

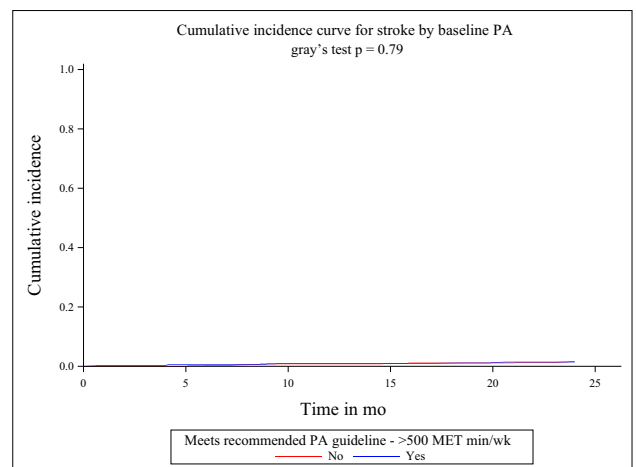


Figure 2. Cumulative incidence curve for stroke.

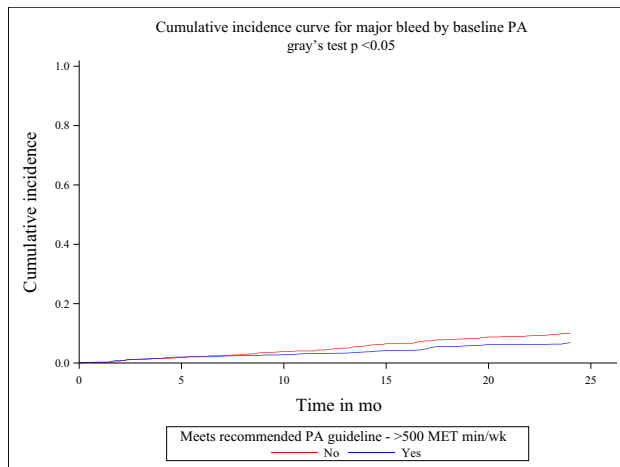


Figure 3. Cumulative incidence curve for major bleeding.

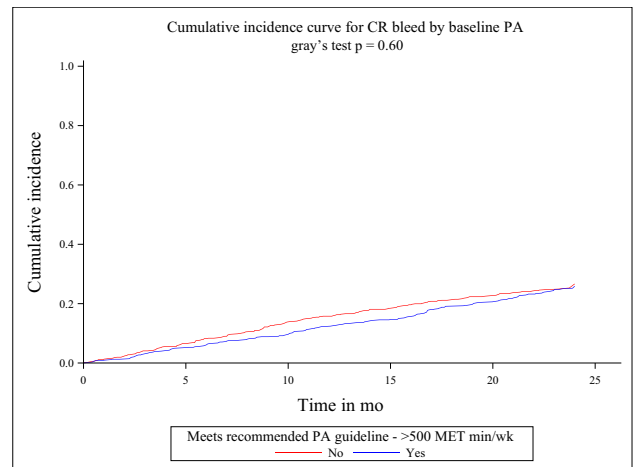


Figure 4. Cumulative incidence curve for clinically relevant bleeding.

a statistically significant association of stroke (aHR 1.44, 95% CI 0.50 to 4.09), episode of major bleeding (aHR 0.86, 95% CI 0.56 to 1.32; Table 2), or a clinically relevant bleeding event (aHR = 1.02, 95% CI 0.82 to 1.27; Table 2) between the 2 groups.

Discussion

In our study following 1,244 older adults with AF, we found that patients meeting the guideline-recommended level of PA had better survival.

Regarding mortality, our finding is consistent with previous research. A retrospective study involving 1,366,422 patients AF with found that exercise-based cardiac rehabilitation was associated with lower odds of all-cause mortality.¹⁵ This conclusion is convincing because of the large number of patients involved. However, we are more precise in quantifying the PA level because we used a standardized questionnaire. In the EURObservational Research Programme on AF study, which included 2,442 patients with AF, higher level of PA (quantified by hours per week) was shown to be associated with a lower mortality risk within 1 year of follow-up.¹⁶ Another study involved 1,117 patients aged ≥ 18 years old from the third wave of the Nord-Trøndelag Health Study 3. The investigators gathered information on PA using the Nord-Trøndelag Health Study 1

questionnaire and divided the groups based on guideline-recommended level of exercise. They found that participants who met the recommended levels have significantly lower mortality than the inactive group and those did not reach the recommended PA level.¹⁷ Compared with these 2 studies, our study is more focused on the geriatric AF population—only the ones aged ≥ 65 years were included. Clinicians and health care providers should incorporate the recommended level of PA in the treatment plan of patients with AF and inform patients of its benefits.

Despite the significant beneficial effect of meeting the recommended level of PA on mortality, no association was observed with stroke or bleeding (i.e., major bleeding and clinically relevant bleeding) in our study. In 1 study including 988 participants on anticoagulation for acute venous thrombosis, patients who were more active were found to experience less major bleeding. In comparison, the indication of anticoagulation use in our study group is AF, and we were more detailed in separating levels of PA (instead of using questions with 4 possible answers, we used a validated questionnaire).¹⁸ In another study including 377,234 participants from the United Kingdom, no causal relation was reported between PA and ischemic stroke, but there is no specific report on stroke rate among the AF population.¹⁹ A meta-analysis including 23 studies reported that participants engaging in some PA have lower risk of both ischemic and hemorrhagic stroke events.²⁰ Differences between

Table 2

Association between self-reported physical activity and clinical outcomes among older adults with atrial fibrillation*

Variables	Mortality	Stroke	Major bleeding episode	Clinically relevant bleeding
Outcome among those engaged in recommended level of PA	29 (4.6%)	9 (1.4%)	43 (6.9%)	184 (29.3%)
Outcome among those not engaged in recommended level of PA	79 (12.8%)	10 (1.6%)	62 (10.1%)	198 (32.1%)
Crude HR (95% CI)	0.39 (0.25-0.59)	0.88 (0.36-2.17)	0.69 (0.47-1.01)	0.90 (0.74-1.10)
Adjusted* HR (95% CI)	0.60 (0.38-0.95)	1.44 (0.50-4.09)	0.86 (0.56-1.32)	1.02 (0.82-1.27)

HR = hazard ratio; PA = physical activity.

* Adjusted Variables: sociodemographic variables (Age, gender, race, marriage, education), Clinical variables (type of atrial fibrillation, body mass index, medical history of chronic lung disease, coronary artery disease, diabetes mellitus, heart failure, hypertension, myocardial infarction, peripheral vascular disease, kidney disease, stroke, and depression).

our study findings and previous studies can be due to the cohort of older adults with AF, larger sample size, sociodemographic and clinical characteristics, instrument used to assess PA, and the period of follow-up. Future longitudinal studies should examine the effect of recommended levels of PA on bleeding and stroke risks among older adults with AF over a longer period of follow-up.

In this observational study, it is possible that patients with fewer risk factors for mortality have greater capacity to engage in regular PA rather than the engagement of activity decreasing mortality risk. Although we adjusted for clinical factors shown to be linked with mortality among adults with AF,^{21,22} there may be factors that may have increased mortality risk and impact the ability to exercise beyond those examined in this study. Randomized controlled trials to promote PA among older adults with AF who can safely engage in regular exercise can shed light on whether increasing PA can extend survival in this population. However, given the robust data demonstrating the physical and mental health benefits of PA,^{4,23–27} we believe encouraging activity in this population is warranted.

This study has additional several strengths. First, we used data from a large cohort of older adults with AF, with multiple co-morbidities and detailed demographic and clinical characteristics. Second, we used the Minnesota Leisure Time PA to quantify PA, which is a validated and standardized questionnaire.²⁴ Third, to the best of our knowledge, this study is among the first to explore whether guideline-recommended level of PA affect clinical outcomes in elderly patients with AF over a period of 2 years. Our study also has limitations. First, the majority of participants identified as non-Hispanic Whites, limiting the generalizability of our findings to adults of other races/ethnicities. Second, it is possible that participants misreported their engagement in specific PA, resulting in misclassification into adherent category. Third, only 19 participants experienced a stroke within the 2-year follow-up, limiting power for examining the association between PA and stroke. Therefore, these results should be interpreted with caution.²⁸

In conclusion, our study found that older adults with AF who engage in the recommended level of PA were less likely to die than adults who were less active over 2 years follow-up. Risk of stroke, major bleeding, and clinically relevant bleeding did not differ between groups. However, PA has been shown to have health benefits beyond mortality, such as modifying cardiovascular risk factors, decreasing AF symptoms and arrhythmia burdens, and boosting mood. Clinicians should encourage guideline-recommended PA, including integrating an exercise plan and cardiac rehabilitation programs, in the treatment plan for older adults with AF.

Disclosures

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Connecticut). The remaining authors have no conflicts of interest to declare.

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