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Characteristics of US military personnel with atrial fibrillation and associated deployment and retention rates

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ABSTRACT

Introduction Atrial fibrillation (AF) is an arrhythmia impacting military occupational performances. Despite being a recognised disqualifying condition, there is no literature describing US military service members with AF. This study aims to describe members with AF diagnoses, the distribution of treatment strategies and associated deployment and retention rates.

Methods Active duty service members identified with AF from 2004 to 2019 were investigated. Cardiovascular profiles, AF management strategies and military dispositions were assessed by electronic medical record review.

Results 386 service members (mean age 35.0±9.4 years; 94% paroxysmal AF) with AF diagnoses were identified. 91 (24%) had hypertension followed by 75 (19%) with sleep apnoea. Mean CHA_2DS_2-VASc scores were low (0.39±0.65). Rhythm treatments were used in 173 (45%) followed by rate control strategies in 155 (40%). 161 (42%) underwent pulmonary vein isolation (PVI). In subgroup analysis of 365 personnel, 147 (40%) deployed and 248 (68%) remained active duty after AF diagnosis. Deployment and retention rates did not differ between those who received no medical therapy, rate control or rhythm strategies (p=0.9039 and p=0.6192, respectively). PVI did not significantly impact deployment or retention rates (p=0.3903 and p=0.0929, respectively).

Conclusion Service members with AF are young with few AF risk factors. Rate and rhythm medical therapies were used evenly. Over two-thirds met retention standards and 40% deployed after diagnosis. There were no differences in deployment or retention between groups who receive rate therapy, rhythm medical therapy or PVI. Prospective evaluation of the efficacy of specific AF therapies on AF burden and symptomatology in service members is needed.

Key messages

- Active duty (AD) military service members diagnosed with atrial fibrillation (AF) are younger patients with diagnoses of hypertension and obstructive sleep apnoea in nearly one quarter.
- Military members evenly receive rate and medical rhythm strategies without differences in deployment or retention rates.
- More than two-third AD meet military retention standards despite AF diagnoses.
- Military retention outcomes for AD military persons with AF are influenced by individual symptomatology, AF burdens and military occupations.

INTRODUCTION

Atrial fibrillation (AF) is a common cardiac dysrhythmia associated with advancing age[1 2] and is projected to impact 5.6 million in the USA by 2050.[3] Athletic and younger populations with low cardiovascular risk profiles are emerging as having a fivefold greater lifetime risk of AF compared with sedentary individuals.[4 5] For perspective, hypertension only imparts a 1.42 greater risk for AF as the most common traditional risk factor.[6 7] The pathophysiology of AF in athletes and younger populations is incompletely understood but is theorised to be related to large fluctuations in vagal tone, atrial stretching mechanisms and increased inflammation associated with high levels of endurance exercise.[4]

Risk factors for AF within the athletic population include male sex, middle age, tall stature, participation in endurance athletics, lifetime exercise of greater than 1500–2000 hours and high occupational physical activity.[5 8–10]

Active duty (AD) military service requires individuals to maintain excellent physical conditioning and participate in high-intensity endurance activities in order to support a diverse array of mission-directed demands.[11–13] Occupational physical fitness requirements coupled with athletic lifestyles is theorised to place many AD service members at increased risk for AF, similar to the civilian athletic population.[14]

The morbidity of AF for AD personnel is a recognised entity but the demographic profiles of service members with AF have not been previously reported. Further, the therapies delivered and offered to military personnel have not been described in light of larger discussions surrounding treatment strategies in the general population. Symptomatic AF may limit the ability of military personnel to complete required duties in many military occupations with associated impacts on military readiness, deployment eligibility and overall retainability.[15] This study aims to characterise US AD service members with AF. Our secondary objective is to analyse the distribution of treatment strategies and associated deployment and retention rates.

METHODS

A retrospective analysis of AD military personnel within the San Antonio Military Health System (US Air Force, Army and Navy services) with

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AF diagnoses between 1 January 2004 and 31 July 2019 was performed. Patients met inclusion criteria if they were AD personnel in the US Air Force, Army or Navy and had confirmed 12-lead electrocardiographic diagnosis of AF by a board-certified cardiologist (n=386). Population baseline characteristics and treatment therapies were evaluated by electronic medical record review. AF was classified as paroxysmal (duration less than 7 days), persistent (duration more than 7 days) or permanent based on electronic health record review. The use of systemic anticoagulation (AC), rate medical therapy and rhythm medical therapy was reviewed in the electronic medical record. The duration of systemic AC treatment was not available from this retrospective analysis. A total of 365 patients with available deployment and military retention information available underwent a subgroup analysis. Service member retention was defined as someone who was not discharged from the service and remained on AD status throughout the duration of the study. Military members were classified as serving a deployment if they were mobilised for determined mission critical purposes or duty tours.

The association between management therapies, future deployments and military disposition was analysed using χ^2 and Fisher's exact test for categorical variables. The t-test was used for comparison of continuous variables. Due to the sample size, we relied on central limit theorem and did not test normality assumption. Data analysis was performed using JMP statistical analysis software V.15 (SAS Institute, Cary, North Carolina, USA).

This research protocol was approved by the institutional review board of the San Antonio Military Medical Center. The institutional review board of San Antonio Military Medical Center waived the need for informed consent because the research involved no more than minimal risk to the participants and the waiver did not adversely affect their rights and welfare. Efforts were made to protect the privacy of all participants, who were assigned a subject number for the purposes of data collection. The data collection spreadsheet was maintained separately from any personally identifiable information and all data were kept in a secure, password-protected file.

RESULTS

A total of 386 AD personnel with a diagnosis of AF in the San Antonio Military Health System during the study period were identified and analysed. The study population had a mean age of 35.0±9.4 years and mean body mass index (BMI) of 28.3±4.3 kg/m^2. Ninety-three per cent were men and 57% were Caucasian (Table 1). Most were AD members of the Army (246, 64%) and most had AF characterised as paroxysmal (361, 94%). The Air Force (119, 31%) and Navy (21, 5%) personnel in the study made up smaller percentages. Very few individuals were classified as having persistent (21, 5%) or permanent AF (4, 1%). The most common observed AF risk factors were

Table 1 Cardiovascular profiles of AD military members diagnosed with AF categorised by treatment strategy

	All (n=386)	No therapy (n=58)	Rate medical therapy (n=155)	Rhythm medical therapy (n=173)	P value
Age, years	35.0±9.4	32.8±9.0	33.9±9.1	36.8±9.5	0.0130
Male, no. (%)	360 (93%)	53 (91%)	142 (92%)	165 (95%)	0.3166
BMI, kg/m^2	28.3±4.3	27.3±3.7	28.6±4.2	28.3±4.5	0.1202
Caucasian, no. (%)	219 (57%)	32 (55%)	81 (52%)	106 (61%)	N/A
African American, no. (%)	81 (21%)	11 (19%)	37 (24%)	33 (19%)	N/A
Asian/Pacific Islander, no. (%)	9 (2%)	3 (5%)	3 (2%)	3 (2%)	N/A
Native American, no. (%)	1 (0.3%)	0 (0%)	1 (0.6%)	0 (0%)	N/A
Hispanic, no. (%)	3 (0.8%)	1 (2%)	2 (1%)	0 (0%)	N/A
Other/unknown race, no. (%)	73 (19%)	11 (19%)	31 (20%)	31 (18%)	N/A
Hypertension, no. (%)	91 (24%)	9 (16%)	37 (24%)	45 (26%)	0.2393
Obstructive sleep apnoea, no. (%)	75 (19%)	11 (19%)	30 (19%)	34 (20%)	0.9934
Diabetes mellitus, no. (%)	6 (2%)	0 (0%)	3 (2%)	3 (2%)	0.3699
Vascular disease, no. (%)	4 (1%)	0 (0%)	2 (1%)	2 (1%)	0.5441
Prior TIA or CVA, no. (%)	5 (1%)	1 (2%)	1 (0.6%)	3 (2%)	0.6293
Coronary artery disease, no. (%)	8 (2%)	1 (2%)	1 (0.6%)	6 (3%)	0.1700
Heart failure, no. (%)	12 (3%)	0 (0%)	6 (4%)	6 (3%)	0.1345
Glucose, mg/dL	95.9±16.4	96.5±18.1	96.6±19.2	95.1±12.7	0.7113
Total cholesterol, mg/dL	181.6±37.7	184.1±37.4	178.6±40.9	183.5±35.0	0.5025
LDL, mg/dL	112.4±46.8	108.2±32.4	112.9±62.4	113.2±32.6	0.8022
HDL, mg/dL	47.4±13.8	50.3±14.9	47.5±14.5	46.5±12.6	0.2262
Triglycerides, mg/dL	121.8±88.8	1331.0±128.8	118.1±81.3	122.2±80.5	0.6647
CHA_2DS_2-VASc score	0.39±0.65	0.31±0.54	0.39±0.60	0.42±0.73	0.4989
HAS-BLED score	0.86±0.63	0.91±0.66	0.82±0.65	0.88±0.61	0.6043
AF classification					
Paroxysmal, no. (%)	361 (94%)	57 (98%)	150 (97%)	154 (89%)	0.0210
Persistent, no. (%)	21 (5%)	1 (2%)	4 (3%)	16 (9%)	N/A
Permanent, no. (%)	4 (1%)	0 (0%)	1 (1%)	3 (2%)	N/A

Values are number (%), mean (±1 SD).

AD, active duty; AF, atrial fibrillation; BMI, body mass index; CVA, cerebrovascular accident; HDL, high density lipoprotein; LDL, low density lipoprotein; N/A, not applicable; TIA, transient ischaemic attack.

Table 2 Cardiovascular profiles of AD military members diagnosed with AF who underwent PVI compared with those without PVI

	All (n=386)	No PVI (n=225)	PVI (n=161)	P value
Age, years	35.0±9.4	34.2±9.0	36.3±9.9	0.0266
Male, no. (%)	360 (93%)	205 (91%)	155 (96%)	0.0390
BMI, kg/m^2	28.3±4.3	28.1±4.5	28.4±4.0	0.2411
Caucasian, no. (%)	219 (57%)	120 (53%)	99 (61%)	N/A
African American, no. (%)	81 (21%)	53 (24%)	28 (17%)	N/A
Asian/Pacific Islander, no. (%)	9 (2%)	4 (2%)	5 (3%)	N/A
Native American, no. (%)	1 (0.3%)	1 (0.4%)	0 (0%)	N/A
Hispanic, no. (%)	3 (0.8%)	3 (1%)	0 (0%)	N/A
Other/unknown race, no. (%)	73 (19%)	44 (20%)	29 (18%)	N/A
Hypertension, no. (%)	91 (24%)	50 (22%)	41 (25%)	0.4591
Obstructive sleep apnoea, no. (%)	75 (19%)	42 (19%)	33 (20%)	0.6332
Diabetes mellitus, no. (%)	6 (2%)	4 (2%)	2 (1%)	0.6712
Vascular disease, no. (%)	4 (1%)	3 (1%)	1 (0.6%)	0.4824
Prior TIA or CVA, no. (%)	5 (1%)	3 (1%)	2 (1%)	0.9337
Coronary artery disease, no. (%)	8 (2%)	4 (2%)	4 (2%)	0.6332
Heart failure, no. (%)	12 (3%)	6 (3%)	6 (4%)	0.5541
Glucose, mg/dL	95.9±16.4	97.0±17.5	94.4±14.8	0.0597
Total cholesterol, mg/dL	181.6±37.7	181.7±39.6	181.5±35.2	0.0597
LDL, mg/dL	112.4±46.8	113.4±56.3	111.2±29.7	0.3210
HDL, mg/dL	47.4±13.8	48.4±13.6	46.1±13.8	0.0586
Triglycerides, mg/dL	121.8±88.8	121.8±88.8	121.7±89.1	0.4946
CHA_2DS_2-VASc score	0.39±0.65	0.40±0.66	0.38±0.65	0.3524
HAS-BLED score	0.86±0.63	0.83±0.64	0.93±0.61	0.0326
AF classification				
Paroxysmal, no. (%)	361 (94%)	220 (98%)	141 (88%)	0.0003
Persistent, no. (%)	21 (5%)	4 (2%)	17 (11%)	N/A
Permanent, no. (%)	4 (1%)	1 (0.4%)	3 (2%)	N/A

Values are number (%), mean (±1 SD).
AF, atrial fibrillation; BMI, body mass index (calculated as kg divided by metres squared); CVA, cerebrovascular accident; HDL, high density lipoprotein; LDL, low density lipoprotein; N/A, not applicable; PVI, pulmonary vein isolation; TIA, transient ischaemic attack.

Figure 1 Pie chart demonstrating the comparison of medical treatment strategies in active duty service members who were deployed (p=0.9039) and were military retained (p=0.6192) after atrial fibrillation diagnosis.

hypertension (91, 24%) and obstructive sleep apnoea (75, 19%). CHA_2DS_2-VASc and HAS-BLED scores were low with means of 0.39±0.65 and 0.86±0.63, respectively (Tables 1 and 2). The cohort had a mean total cholesterol 181.6±37 mg/dL, mean low density lipoprotein 112.4±46 mg/dL, mean high density lipoprotein 47.4±13 mg/dL, mean random glucose 95.9±16 mg/dL and mean triglycerides 121.8±88 mg/dL. There were 6 (2%) service members with a diagnosis of diabetes mellitus and 12 (3%) with a diagnosis of heart failure.

Rhythm treatments (defined as receiving antiarrhythmic drug therapy) were used in 173 (45%) members in comparison to rate control treatments in 155 (40%). A total of 58 (15%) service members did not receive rate or rhythm specific therapies. Those who received rhythm medical therapies were on average older than patients treated with no medication or rate control agents (rhythm, 36.8±9.5 vs rate, 33.9±9.1 vs no treatment 32.8±9.0; p=0.0130). Sixteen of the 21 (76%) patients with AF classified as persistent received rhythm medical therapy (Table 1).

A total of 161 (42%) service members underwent pulmonary vein isolation (PVI) (Table 2) and those treated with PVI were on average older (PVI, 36.3±9.9 vs no PVI, 34.2±9.0; p=0.0266). There was no significant difference in BMI, cardiovascular medical comorbidities, lipid profiles, CHA_2DS_2-VASc score and HAS-BLED score between the two treatment groups (Table 2). Seventeen of the 21 (81%) patients with AF classified as persistent underwent PVI (Table 2).

In a subgroup analysis of 365 military personnel, 147 (40%) deployed and 248 (68%) met AD retention standards (Table 3). Deployment rates did not differ between groups who received no medical therapy, rate control strategy or rhythm agents (no medical therapy, 16% vs rate control strategy, 41% vs rhythm strategy, 44%; p=0.9039) (Figure 1 and Table 3). Similarly, military retention rates did not statistically differ among the

Table 3 Subgroup analysis of deployment and military retention rates for the medical and procedural treatment strategies

	All (n=365)	Deployed (n=147)	Non-deployed (n=218)	Retained (n=248)	Discharged (n=117)
Medical therapies for AF					
No medical therapy	55 (15%)	23 (16%)	32 (15%)	39 (16%)	16 (14%)
Rate medical therapy	146 (40%)	60 (41%)	86 (39%)	95 (38%)	51 (44%)
Rhythm medical therapy	164 (45%)	64 (44%)	100 (46%)	114 (46%)	50 (43%)
Rates of PVI for AF					
No PVI	211 (58%)	81 (55%)	130 (60%)	136 (55%)	75 (64%)
PVI	154 (42%)	66 (45%)	88 (40%)	112 (45%)	42 (36%)
History of anticoagulation management for AF					
No anticoagulation	194 (53%)	75 (51%)	119 (55%)	125 (50%)	69 (59%)
Warfarin	119 (33%)	58 (39%)	61 (28%)	89 (36%)	30 (26%)
Direct oral anticoagulant	52 (14%)	14 (10%)	38 (17%)	34 (14%)	18 (15%)

Values are number, (%).
AF, atrial fibrillation; PVI, pulmonary vein isolation.

treatment groups (no therapy, 16% vs rate control, 38% vs rhythm agent, 46%; p=0.6192) (Figure 1 and Table 3). A history of PVI did not significantly impact deployment (no PVI, 55% vs PVI, 45%; p=0.3903) or retention rates (no PVI, 55% vs PVI, 45%; p=0.0929) (Figure 2). 119 (33%) vs 52 (14%) of the subgroup was treated with warfarin and direct oral anticoagulant, respectively. Binomial logistic regression model analysis identified obstructive sleep apnoea to be a risk factor for identifying service members at risk for not deploying with OR 2.88, 95% CI (1.50 to 5.40) and being discharged from AD service with an OR 2.20, 95% CI (1.20 to 3.90).

DISCUSSION

To date, there have only been generalised recommendations and management schemes for the military population with AF based on individual expert recommendations and anecdotal cases. Hunter *et al* described the military discharges that occur annually within the UK Armed Forces as a result of AF diagnoses without clear reference of the specific rates.[15] In their review, they discuss the spectrum of AF treatment in the UK military population and the implications for individual medical employment standards in aviators, divers and military drivers.[15] Guettler *et al* also reviewed specific implications and management of AF in the military population without offering data describing the AD demographics and outcomes.[16]

The present study first describes AF management strategies and their association with military dispositions in a cohort population of US AD military service members across three separate branches. Military personnel with AF were younger on average (mean age 35.0±9.4) with few cardiovascular risk factors compared with other contemporary AF population studies such as CASTLE-AF[17] and CABANA.[18] Based on our described demographic data, we theorise that the aetiology of AF in the majority of military personnel is secondary to one or combination of the following categories: (1) athletic lifestyle, (2) traditional AF risk factors, (3) acute illnesses or intoxications or (4) idiopathic aetiology. Twenty-four per cent of service members with AF had hypertension and 19% had obstructive sleep apnoea. The remaining large percentage of study persons without hypertension, sleep apnoea or other medical history concerns the authors to believe that an athletic lifestyle is one of the driving etiologies for AF in our particular population.

Military members with AF diagnoses had low stroke risks based on CHA_2DS_2-VASc scores but yet 47% of the entire study population was observed to have been prescribed systemic AC. In light of AD personnel having lower CHA_2DS_2-VASc scores not equal or greater than 2, this suggests that AC was most likely prescribed for transient indications such as cardioversions or ablations. We can conclude that military members diagnosed with AF were eligible for deployment even if they had a history of systemic AC prescriptions. Forty-nine per cent of AD of those who deployed after AF diagnosis had a history of prior AC utilisation. As a limitation of this study, we are unable to make conclusions about whether or not individual members deployed while actively maintained on systemic AC and a prospective study would be needed in order to clarify this information. Currently, Department of Defense policies would prohibit deployment of an AD service member while being maintained on therapeutic AC in most situations.

Service members evenly received rate and rhythm control agents and many underwent PVI (42%). PVI was not specifically observed to influence future deployment or military retention rates. This study is limited in that we are unable to evaluate for endpoints of symptomatology and AF burden as these could have been bettered with PVI interventions.

Subsequent deployment and military retention rates in those diagnosed with AF were similar irrespective of medical or procedural treatment strategy. The data in this study clearly demonstrate that nearly 70% of all persons with AF can still meet military retention standards after medical board evaluation. The statistically significant OR for identifying persons with obstructive sleep apnea to be at risk of not deploying or being discharged from the service is relevant for the military practitioner. Clinical practice and anecdotal experience would support this additional finding as likely an independent and supporting risk factor since sleep apnoea is a well-recognised condition that frequently leads to automatic and independent medical board evaluations.

The authors are led to believe that the high retention rate observed is a function of military medical board evaluations accounting for individual clinical AF burdens, symptomatology and one's specific occupation. Further, we propose that this group of younger patients with predominately paroxysmal AF presumably carried a low overall AF burden. Not available in this present study but relevant to this discussion would be the rates of occupation changes as a result of AF diagnosis.

In clinical practice, patients with AF often longitudinally receive a combination of both rhythm and rate therapies and in retrospective review of our cohort, we were limited to classifying patients into broad categories of therapies received. A timeline of specific therapies in this observational study was not available for a correlating statistical analysis. Additionally not available in this study is specific exercise quantification for individual military members in order to clearly correlate exercise or athletic lifestyles as a driving aetiology of AF. The distribution of service members' branch affiliations was very imbalanced and the majority of the members were in the Army, limiting the ability to complete an analysis comparing management of AF and outcomes between the three services. Despite these limitations, this is the first study that describes AF therapies and associated outcomes in the US AD military population.

Service members with AF are young with few AF risk factors who often met retention standards and deployed after diagnosis. There were no differences in deployment or retention between groups who receive rate therapy, rhythm medical therapy or PVI. Prospective study of AF management in military personnel is needed to evaluate the effect of AF therapies on symptom relief and AF burden.

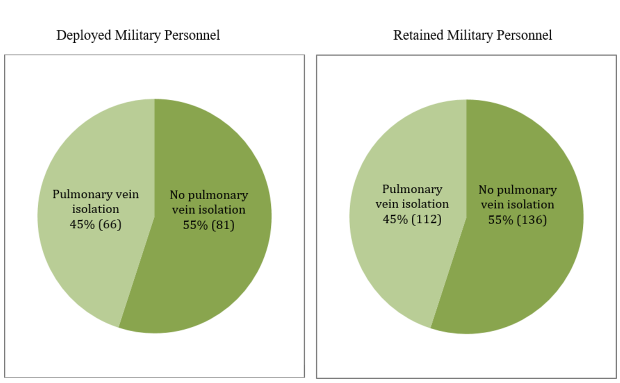

Figure 2 Pie chart demonstrating the comparison of pulmonary vein isolation in active duty service members who were deployed (p=0.3903) and were military retained (p=0.0929) after atrial fibrillation diagnosis.

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Patient consent for publication Not required.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. The full dataset is available from the corresponding author (andrea.n.keithler.mil@mail.mil) on request. Participant consent for data sharing was not obtained but the presented data are anonymised and risk of identification is low.

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REFERENCES

1 January CT, Wann LS, Calkins H, *et al*. 2019 AHA/ACC/HRS focused update of the 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 clinical practice guidelines and the heart rhythm society in collaboration with the Society of thoracic surgeons. *Circulation* 2019;140:e125–51.
2 January CT, Wann LS, Alpert JS, Conti JB, Murray KT, *et al*. 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. *J Am Coll Cardiol* 2014;64:e1–76.
3 Go AS, Hylek EM, Phillips KA, Henault LE, *et al*. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the anticoagulation and risk factors in atrial fibrillation (atria) study. *JAMA* 2001;285:2370–5.
4 Sharma S, Merghani A, Mont L. Exercise and the heart: the good, the bad, and the ugly. *Eur Heart J* 2015;36:1445–53.
5 Raju H, Kalman JM. Management of atrial fibrillation in the athlete. *Heart Lung Circ* 2018;27:1086–92.
6 Krahn AD, Manfreda J, Tate RB, *et al*. The natural history of atrial fibrillation: incidence, risk factors, and prognosis in the Manitoba follow-up study. *Am J Med* 1995;98:476–84.
7 Kannel WB, Abbott RD, Savage DD, *et al*. Epidemiologic features of chronic atrial fibrillation: the Framingham study. *N Engl J Med* 1982;306:1018–22.
8 Flannery MD, Kalman JM, Sanders P, *et al*. State of the art review: atrial fibrillation in athletes. *Heart, Lung and Circulation* 2017;26:983–9.
9 Skielboe AK, Marott JL, Dixen U, *et al*. Occupational physical activity, but not leisure-time physical activity increases the risk of atrial fibrillation: the Copenhagen City heart study. *Eur J Prev Cardiol* 2016;23:1883–93.
10 Wilhelm M. Atrial fibrillation in endurance athletes. *Eur J Prev Cardiol* 2014;21:1040–8.
11 Army Physical Fitness Test (APFT). Appendix A:A1-24.
12 Guide 5, physical readiness test (PRT), guide 5: physical readiness test (PRT), 2019. Available: http://www.public.navy.mil/bupers-npc/support/21st_Century_Sailor/physical/Documents/Guide 5- Physical Readiness Test 2016.pdf
13 Air force instruction 36-2905: personnel fitness program, 2013. Available: https://www.afpc.af.mil/Portals/70/documents/Home/AF Fitness Program/AFI 36-2905_FITNESS PROGRAM.pdf
14 Hunter AH, Cox AT, D'Arcy J, *et al*. Atrial fibrillation in the military patient: a review. *J R Army Med Corps* 2015;161:237–43.
15 Dod instruction 6130.03 medical standards for appointment, Ensistement or induction into the military services 2018:1–18.
16 Guettler N, Bron D, Manen O, *et al*. Management of cardiac conduction abnormalities and arrhythmia in aircrew. *Heart* 2019;105:s38–49.
17 Marrouche NF, Brachmann J, Andresen D, *et al*. Catheter ablation for atrial fibrillation with heart failure. *N Engl J Med* 2018;378:417–27.
18 Packer DL, Mark DB, Robb RA, *et al*. Effect of catheter ablation vs antiarrhythmic drug therapy on mortality, stroke, bleeding, and cardiac arrest among patients with atrial fibrillation: the CABANA randomized clinical trial. *JAMA* 2019;321:1261–74.