





Assessment of Knowledge Regarding Risks and Benefits of the Use of Non-Vitamin K Antagonist Oral Anticoagulants

Journal of Primary Care & Community Health
Volume 13: 1–8
© The Author(s) 2022
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/21501319221118806
journals.sagepub.com/home/jpc


Jose Raul Valery¹ , Ahmad Marar², George Pujalte³, Cynthia Ward⁴, Yousif M. Abdelmoneim⁵, Patrick J. Fitzgerald¹, Edson Mwakyanjala¹, Dana M. Harris¹ , Loren Murray¹, Michael G. Heckman⁶, Launia J. White⁶, and Fernando Stancampiano¹ 

Abstract

Background: Non-vitamin K antagonist oral anticoagulants (NOAC) have replaced vitamin K antagonist (VKA) oral anticoagulants as the first-line treatment option for stroke prevention in high-risk patients with atrial fibrillation. With VKA therapy, disease and treatment-related knowledge is associated with improved adherence and outcomes. There is concern that due to the lack of need for ongoing visits for laboratory monitoring in patients on NOACs, there is less opportunity for education, leading to poor disease- and treatment-related knowledge in this patient group. **Methods:** One hundred ninety-nine (199) patients presenting to 2 primary care clinics on NOAC therapy were surveyed regarding atrial fibrillation and their knowledge regarding NOACs. Chart review was completed to determine patient characteristics and data obtained was compared with survey results to determine the accuracy of the survey responses. **Results:** Patients with a lower degree of NOAC knowledge tended to be older ($P < .001$), have higher Charlson Comorbidity Index scores ($P = .001$), use apixaban more often ($P = .008$), and have been on NOACs for a shorter time period ($P = .007$). **Conclusions:** There is an opportunity to improve NOAC-related knowledge in patients with atrial fibrillation. When developing educational interventions, patient characteristics associated with poor knowledge should be considered. Based on our results, these are patients who are older, more medically complex, are on apixaban, and have been on NOAC therapy for a shorter duration.

Keywords

DOAC, NOAC, atrial fibrillation, disease and treatment knowledge, oral anticoagulation, patient education, medication adherence

Dates received: 19 May 2022; revised: 20 July 2022; accepted: 22 July 2022.

Background

Non-vitamin K antagonist oral anticoagulation (NOAC) has mainly replaced vitamin K antagonist (VKA) oral anticoagulation as the first-line treatment option for stroke prophylaxis in patients with non-valvular atrial fibrillation.¹ NOACs offer improved efficacy, safety, practicality, and reduced drug-drug and drug-food interactions.¹ The reliable anticoagulant effect observed with NOACs eliminates the need for frequent laboratory monitoring required with warfarin therapy.¹

As with VKAs, NOAC therapy is associated with improved outcomes when patients demonstrate improved knowledge about their condition and treatment.² Patients on

¹Division of Community Internal Medicine, Mayo Clinic Florida, Jacksonville, FL, USA

²University of Florida College of Pharmacy, Gainesville, FL, USA

³Division of Family Medicine, and Orthopedics, Mayo Clinic Florida, Jacksonville, FL, USA

⁴Primary Care Pharmacy, Mayo Clinic Florida, Jacksonville, FL, USA

⁵Division of Laboratory Medicine and Pathology Mayo Clinic Florida, Jacksonville, FL, USA

⁶Division of Clinical Trials and Biostatistics, Mayo Clinic Florida, Jacksonville, FL, USA

Corresponding Author:

Jose Raul Valery, Division of Community Internal Medicine, Mayo Clinic Florida, 4500 San Pablo Road, Jacksonville, FL 32224, USA.
Email: Valery.jose@mayo.edu.



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons

Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

VKA therapy experience fewer major bleeding and thromboembolic events when they spend a greater amount of time in therapeutic range (TTR), equivalent to an international normalized ratio (INR) of 2.0 to 3.0 in patients with non-valvular atrial fibrillation.³ Improved patient knowledge regarding VKA treatment is associated with higher TTR.⁴ Lack of knowledge about atrial fibrillation and appropriate therapy is thought to be a factor associated with poor-adherence.² Among patients on NOAC therapy, poor adherence is associated with worse outcomes.

Interestingly, research shows that adherence to VKAs is higher than to NOACs. A large retrospective study showed persistence rates at 1, 3, and 5 years of 93.2%, 89.4%, and 87.2%, respectively for patients with atrial fibrillation on VKA therapy compared with 88.8%, 84.3%, and 81.3%, respectively for patients on NOACs.⁵ There is also evidence suggesting that there are a larger number of knowledge gaps in patient taking NOACs compared with patients on VKA therapy.⁶ A similar study at our institution in 2019 found that the majority of patients on VKA therapy demonstrated a poor level of knowledge regarding stroke risk reduction and the rate of major bleeding events, despite being generally well-educated and participating in regular educational sessions in a nurse-led anticoagulation clinic.⁷ As recommended by the 2021 European Heart Rhythm Association Practical Guide, the NOAC prescribing physician should discuss risks and benefits of therapy at initiation and periodically during follow-up appointments.¹ However, since NOAC therapy does not require frequent INR monitoring, it may lead to less frequent reminders, communication, and educational updates. This, in turn, may lead to lower adherence and a higher frequency of knowledge gaps with NOAC therapy compared with VKA therapy.

Targeted educational interventions have shown effectiveness in improving adherence to NOAC therapy.⁸ It is helpful to understand the characteristics of patients with poor knowledge and consequently at high risk of low adherence to help better target educational interventions.

This study aimed to examine the level of patient knowledge regarding risks and benefits of NOAC therapy among patients with non-valvular atrial fibrillation, and to characterize those at risk of poor adherence due to lack of knowledge.

Methods

Study Subjects

After IRB approval, a total of 199 patients who received NOACs at Mayo Clinic Florida between August 2020 and April 2021 were included in this retrospective study. Information collected from chart review included age, stroke risk factors, congestive heart failure (CHF), hypertension, age ≥ 75 , diabetes, stroke, vascular disease, age 65 to 74 and

sex category (female), bleeding risk factors, Outcomes Registry for Better Informed Treatment (ORBIT) score, Charlson Comorbidity Index (CCI), NOAC type, NOAC indication, and length of time on NOAC (Table 1). Adult patients presenting for any appointment type, paneled in a primary care clinic, and with a NOAC on their active medication list were approached by the study team during rooming to invite them to participate. After consent those interested in participating filled out a 20-question survey (Table 2) and were assessed regarding NOAC knowledge according to their answers for 9 of these questions (questions 1, 2, 3, 4, 6, 7, 10, 12, and 19). In patients with atrial fibrillation, the number of correctly answered questions was 0 for 1 patient, 1 for 10 patients, 2 for 50 patients, 3 for 58 patients, 4 for 51 patients, 5 for 17 patients, 6 for 10 patients, and 7 for 2 patients. 3 (Range: 0-7). Patients were classified as having low, moderate, or high NOAC knowledge according to number of correct answers (low: 0-2, moderate: 3-4, high: 5-7). These categories were chosen based on examination of the distribution of number of correctly answered questions, where the goal was for each category to have a similar range and also a reasonable sample size.

Questions 1, 2, 3, 4, 6, 7, 10, 12, and 19 were intended to measure level of knowledge regarding NOAC treatment and indication (1, 2, 19), benefits (3, 4), risks (6, 10, 12), and interactions (7). Responses to questions 1, 2, 3, 6, and 19 were compared with the patient's medical record to determine if the answers were correct. We used the CHA2DS2-VASc score and the ORBIT score to calculate stroke and bleeding risk for each patient, respectively.^{9,10} More than (>) 50% was the correct response to question 4. Question 7 was correct if aspirin, NSAIDs, antibiotics and alcohol were all selected. Question 10 was a yes/no question and "yes" was considered correct. Warfarin was the correct answer to question 12.

Statistical Analysis

Continuous variables were summarized with the sample median and range. Categorical variables were summarized with number and percentage of patients. In patients with atrial fibrillation, comparisons of characteristics and survey responses according to the ordinal level of NOAC knowledge variable (low, moderate, and high) were made using Spearman's test of correlation (continuous variables), a Cochran-Armitage trend test (categorical variables with 2 categories), of Fisher's exact test (categorical variables with >2 categories). For survey questions, only those that were not used to define the low, moderate, and high categories were compared between these 3 groups. *P*-values < .05 were considered as statistically significant. All statistical tests were 2-sided. Statistical analyses were performed using SAS (version 9.4; SAS Institute, Inc., Cary, North Carolina).

Table 1. Summary of Patient Characteristics in the Overall Group and According to Atrial Fibrillation.

| Variable | N | Median (minimum, maximum) or No. (%) of patients | | |
|---------------------------------|-----|--|--|----------------------------------|
| | | All patients (N=199) | NOAC indication of atrial fibrillation (N=142) | NOAC indication of DVT/PE (N=57) |
| Age (years) | 199 | 76 (24, 93) | 77 (24, 93) | 71 (44, 92) |
| Stroke risk factors | | | | |
| CHF or LVEF ≤ 40% | 199 | 49 (24.6%) | 42 (29.6%) | 7 (12.3%) |
| Hypertension | 199 | 155 (77.9%) | 124 (87.3%) | 31 (54.4%) |
| Age ≥75 years | 199 | 109 (54.8%) | 89 (62.7%) | 20 (35.1%) |
| Diabetes | 199 | 49 (24.6%) | 36 (25.4%) | 13 (22.8%) |
| Prior stroke/TIA | 199 | 43 (21.6%) | 35 (24.6%) | 8 (14.0%) |
| Vascular disease | 199 | 173 (86.9%) | 125 (88.0%) | 48 (84.2%) |
| Age 65-74 years | 199 | 51 (25.6%) | 33 (23.2%) | 18 (31.6%) |
| Female sex | 199 | 79 (39.7%) | 54 (38.0%) | 25 (43.9%) |
| CHA2DS2-VASc score | 199 | 4 (0, 8) | 5 (0, 8) | 3 (0, 7) |
| Bleeding risk factors | | | | |
| Age >74 years | 199 | 109 (54.8%) | 89 (62.7%) | 20 (35.1%) |
| Anemia | 199 | 67 (33.7%) | 47 (33.1%) | 20 (35.1%) |
| History of bleeding | 199 | 41 (20.6%) | 33 (23.2%) | 8 (14.0%) |
| CKD | 199 | 87 (43.7%) | 66 (46.5%) | 21 (36.8%) |
| Treatment with antiplatelet | 199 | 37 (18.6%) | 25 (17.6%) | 12 (21.1%) |
| ORBIT score | 199 | 2 (0, 7) | 2 (0, 7) | 2 (0, 5) |
| Charlson comorbidity score | 199 | 7 (0, 19) | 7 (0, 19) | 6 (0, 15) |
| NOAC type | | | | |
| Apixaban (Eliquis) | 199 | 170 (85.4%) | 124 (87.3%) | 46 (80.7%) |
| Rivaroxaban (Xarelto) | 199 | 28 (14.1%) | 17 (12.0%) | 11 (19.3%) |
| Dabigatran (Pradaxa) | 199 | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Edoxaban (Savaysa) | 199 | 1 (0.5%) | 1 (0.7%) | 0 (0.0%) |
| Length of time on NOAC (months) | 199 | 5 (1, 68) | 6 (1, 58) | 5 (1, 68) |

Results

A summary of patient characteristics is shown in Table 1 for the overall patient group (N=199), the subgroup of patients with a NOAC indication of atrial fibrillation (N=142), and the subgroup of patients with a NOAC indication of DVT/PE (N=57). Of the 142 atrial fibrillation patients, 50 (35.2%) were classified as having low NOAC knowledge, 73 (51.4%) had moderate NOAC knowledge, and 19 (13.4%) had high NOAC knowledge. A comparison of patient characteristics according to level of NOAC knowledge in atrial fibrillation patients is shown in Table 2. Patients with a higher degree of NOAC knowledge tended to: (1) be younger ($P < .001$); (2) have a lower CCI score ($P = .001$); (3) less often have apixaban as the NOAC type ($P = .008$); and (4) and have been on NOAC for a longer length of time ($P = .007$).

Table 3 displays a comparison of survey questions according to degree of NOAC knowledge in atrial fibrillation patients. Survey questions are summarized in Supplemental Table 4 for the overall group and separately according to atrial fibrillation (see Supplemental Material).

Discussion

Improved adherence to NOAC therapy is associated with improved outcomes in patients with atrial fibrillation. NOAC studies with a follow-up period of at least 1 year have shown a low and concerning adherence rate ranging between 63.3% and 79.8%.¹¹ Educational strategies appear helpful in improving adherence rates. For example, a study using a mixed educational intervention and calendar reminder strategy found an improvement in adherence to >91.0%.⁸ Educational strategies have also been found to lead directly to improved outcomes,¹² likely through improved adherence. There are multiple existing recommendations regarding materials to use for patient education and improved adherence, including technology aids, pill organizers, periodic follow-up, family education, pharmacy databases, simplified regimens, remote monitoring, and shared-decision making tools.^{1,13} Selecting an optimal educational strategy likely depends on underlying patient factors. Characterizing patient factors associated with low baseline knowledge is likely helpful in selecting and targeting educational interventions.

Table 2. Comparison of Patient Characteristics According to Level of NOAC Knowledge in Patients With Atrial Fibrillation.

| Variable | N | Median (minimum, maximum) or No. (%) of patients | | | P-value |
|---------------------------------|-----|--|---------------------------------|----------------------------|---------|
| | | Low NOAC knowledge (N=61) | Moderate NOAC knowledge (N=109) | High NOAC knowledge (N=29) | |
| Age (years) | 142 | 81 (51, 92) | 76 (24, 93) | 73 (43, 90) | .002 |
| Stroke risk factors | | | | | |
| CHF or LVEF ≤ 40% | 142 | 18 (36.0%) | 21 (28.8%) | 3 (15.8%) | .11 |
| Hypertension | 142 | 47 (94.0%) | 61 (83.6%) | 16 (84.2%) | .13 |
| Age ≥75 years | 142 | 38 (76.0%) | 44 (60.3%) | 7 (36.8%) | .002 |
| Diabetes | 142 | 10 (20.0%) | 21 (28.8%) | 5 (26.3%) | .40 |
| Prior stroke/TIA | 142 | 13 (26.0%) | 18 (24.7%) | 4 (21.1%) | .69 |
| Vascular disease | 142 | 47 (94.0%) | 61 (83.6%) | 17 (89.5%) | .29 |
| Age 65-74 years | 142 | 9 (18.0%) | 16 (21.9%) | 8 (42.1%) | .063 |
| Female sex | 142 | 20 (40.0%) | 27 (37.0%) | 7 (36.8%) | .75 |
| CHA2DS2-VASc score | 142 | 5 (2, 8) | 5 (0, 8) | 4 (1, 6) | .072 |
| Bleeding risk factors | | | | | |
| Age >74 years | 142 | 38 (76.0%) | 44 (60.3%) | 7 (36.8%) | .002 |
| Anemia | 142 | 15 (30.0%) | 27 (37.0%) | 5 (26.3%) | .94 |
| History of bleeding | 142 | 15 (30.0%) | 11 (15.1%) | 7 (36.8%) | .81 |
| CKD | 142 | 27 (54.0%) | 30 (41.1%) | 9 (47.4%) | .36 |
| Treatment with antiplatelet | 142 | 11 (22.0%) | 10 (13.7%) | 4 (21.1%) | .61 |
| ORBIT score | 142 | 3 (0, 7) | 2 (0, 7) | 2 (0, 6) | .24 |
| Charlson comorbidity score | 142 | 8 (3, 16) | 6 (0, 19) | 5 (2, 12) | .001 |
| NOAC type | 142 | | | | .008 |
| Apixaban (Eliquis) | | 48 (96.0%) | 63 (86.3%) | 13 (68.4%) | |
| Rivaroxaban (Xarelto) | | 2 (4.0%) | 10 (13.7%) | 5 (26.3%) | |
| Dabigatran (Pradaxa) | | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | |
| Edoxaban (Savaysa) | | 0 (0.0%) | 0 (0.0%) | 1 (5.3%) | |
| Length of time on NOAC (months) | 142 | 5 (1, 22) | 6 (1, 58) | 7 (1, 33) | .007 |

P-values result from Spearman's test of correlation (continuous variables), a Cochran-Armitage trend test (categorical variables with 2 groups) or Fisher's exact test (categorical variables with >2 groups).

In our study, older patients had a lower level of knowledge about NOAC therapy, highlighting a group who would likely benefit from additional and more frequent education. This is particularly important given the higher risk of complications in this group.¹⁴ Patients classified in the high NOAC knowledge group had a median age of 73 compared with a median age of 81 in the low NOAC knowledge group. This is consistent with past studies showing lower self-health-related knowledge in patients of advanced age.¹⁵ A systematic review of barriers to medication adherence in the elderly identified poor disease-related knowledge as a significant barrier.¹⁶ Effective educational interventions in this group may require an innovative approach that takes into account several factors, including health literacy, given that more than half of adults aged 65 and older have limited literacy skills.¹⁷ The American Geriatrics Society calls for educational materials for older adults to be written at no higher than a sixth-grade (11-12 years of age) reading level.¹⁷ However, a recent assessment of online patient education materials found that 99% of published online tools are written at above this level.¹⁸

The proportion of patients with atrial fibrillation on apixaban therapy was higher in the group classified as having low knowledge when compared with the group classified as having high knowledge. This finding was statistically significant although there was a small number of patients in this study on other NOACs. A possible explanation for this is that apixaban is prescribed more frequently in patients at about the age threshold which we found to be associated with low knowledge. It is also possible that education provided with NOAC therapy has fluctuated or decreased overtime. Eliquis (apixaban) was FDA approved for use in patients with atrial fibrillation in December of 2012, 1 year after the approval of Xarelto (rivaroxaban) for the same indication in November of 2011.^{19,20} Any variation in the amount of education provided overtime could have a confounding effect on these results.

We also found that patients with a higher CCI had a lower level of NOAC knowledge. The CCI score includes congestive heart failure (CHF), stroke and coronary artery disease (CAD), making a population with a high CCI particularly susceptible to poorer outcomes related to low

Table 3. Comparison of Survey Questions According to Level of NOAC Knowledge in Patients With Atrial Fibrillation.

| Variable | N | No. (%) of patients | | | P-value |
|--|-----|---------------------------|--------------------------------|----------------------------|-----------------|
| | | Low NOAC knowledge (N=50) | Moderate NOAC knowledge (N=73) | High NOAC knowledge (N=19) | |
| 1. Which medical condition are you taking the blood thinner for? | 136 | | | | NA ^a |
| Atrial fibrillation | | 33 (70.2) | 61 (87.1) | 19 (100.0) | |
| Clot in the legs or lungs (DVT/PE) | | 0 (0.0) | 2 (2.9) | 0 (0.0) | |
| Heart valve problem | | 0 (0.0) | 1 (1.4) | 0 (0.0) | |
| Not sure | | 6 (12.8) | 4 (5.7) | 0 (0.0) | |
| Other | | 8 (17.0) | 2 (2.9) | 0 (0.0) | |
| 2. Did you ever have a stroke? (yes) | 142 | 8 (16.0) | 17 (23.3) | 4 (21.1) | NA ^a |
| 3. What would be your risk of stroke within a given year If you did not take the blood thinner? | 142 | | | | NA ^a |
| <5% | | 1 (2.0) | 1 (1.4) | 4 (21.1) | |
| 5%-10% | | 1 (2.0) | 2 (2.7) | 3 (15.8) | |
| 11%-50% | | 1 (2.0) | 9 (12.3) | 2 (10.5) | |
| >50% | | 4 (8.0) | 10 (13.7) | 3 (15.8) | |
| Not sure | | 43 (86.0) | 51 (69.9) | 7 (36.8) | |
| 4. The blood thinner reduces your risk of stroke in a given year by. . . | 142 | | | | NA ^a |
| <5% | | 2 (4.0) | 4 (5.5) | 1 (5.3) | |
| 5%-10% | | 2 (4.0) | 1 (1.4) | 1 (5.3) | |
| 11%-50% | | 5 (10.0) | 9 (12.3) | 3 (15.8) | |
| >50% | | 0 (0.0) | 17 (23.3) | 10 (52.6) | |
| Not sure | | 41 (82.0) | 42 (57.5) | 4 (21.1) | |
| 5. Often times the decision to start a patient on a blood thinner is based on a score (a number) called CHADS or CHADS-VASC. Do you know you own score?, (yes) | 141 | 2 (4.1) | 2 (2.7) | 6 (31.6) | <.001 |
| 6. Your risk of serious bleeding (internal bleeding or bleeding that requires transfusion) in a given year is. . . | 141 | | | | NA ^a |
| <5% | | 3 (6.1) | 8 (11.0) | 9 (47.4) | |
| 5%-10% | | 3 (6.1) | 7 (9.6) | 4 (21.1) | |
| 11%-50% | | 3 (6.1) | 5 (6.8) | 0 (0.0) | |
| >50% | | 1 (2.0) | 0 (0.0) | 1 (5.3) | |
| Not sure | | 39 (79.6) | 53 (72.6) | 5 (26.3) | |
| 7. Which of the following interacts with your blood thinner and increases your risk of bleeding? | | | | | |
| Aspirin | 142 | 20 (40.0) | 55 (75.3) | 19 (100.0) | NA ^a |
| Anti-inflammatories (Advil, Ibuprofen, Aleve, Naproxen, and prescription ones) | 142 | 16 (32.0) | 34 (46.6) | 10 (52.6) | NA ^a |
| Antibiotics | 142 | 2 (4.0) | 2 (2.7) | 1 (5.3) | NA ^a |
| Alcohol | 142 | 10 (20.0) | 21 (28.8) | 8 (42.1) | NA ^a |
| Leafy vegetables | 142 | 2 (4.0) | 7 (9.6) | 1 (5.3) | NA ^a |
| Not sure | 142 | 21 (42.0) | 12 (16.4) | 0 (0.0) | NA ^a |
| 8. Have you ever heard the name of your blood thinner before it was prescribed to you? (yes) | 141 | 36 (73.5) | 53 (72.6) | 15 (78.9) | .65 |
| 9. What type of education/information did you receive when your current blood thinner was prescribed? | | | | | |

(continued)

Table 3. (continued)

| Variable | N | No. (%) of patients | | | P-value |
|---|-----|---------------------------|--------------------------------|----------------------------|-----------------|
| | | Low NOAC knowledge (N=50) | Moderate NOAC knowledge (N=73) | High NOAC knowledge (N=19) | |
| Discussion with the doctor or nurse | 142 | 34 (68.0) | 58 (79.5) | 17 (89.5) | .16 |
| I was told to go online (Internet) to read about it | 142 | 0 (0.0) | 0 (0.0) | 3 (15.8) | .002 |
| I was given a brochure/pamphlet | 142 | 1 (2.0) | 11 (15.1) | 6 (31.6) | .002 |
| None | 142 | 1 (2.0) | 4 (5.5) | 0 (0.0) | .56 |
| I don't recall | 142 | 14 (28.0) | 9 (12.3) | 0 (0.0) | .008 |
| 10. Is there an antidote for your blood thinner (a medication your doctors could administer if you had serious bleeding?) (yes) | 140 | 1 (2.1) | 11 (15.1) | 11 (57.9) | NA ^a |
| 11. Did you ever take the blood thinner Warfarin also known as Coumadin or Jantoven? (yes) | 142 | 20 (40.0) | 26 (35.6) | 10 (52.6) | .11 |
| 12. Which of the following 2 medications carriers of higher risk of serious bleeding | 141 | | | | NA ^a |
| Your current blood thinner | | 3 (6.0) | 5 (6.9) | 0 (0.0) | |
| Warfarin | | 8 (16.0) | 50 (69.4) | 19 (100.0) | |
| Not sure | | 39 (78.0) | 17 (23.6) | 0 (0.0) | |
| 13. What type of insurance did you carry when your blood thinner was started? | 131 | | | | .21 |
| Government (Medicare/Medicaid) | | 34 (72.3) | 36 (53.7) | 10 (58.8) | |
| Private (Commercial) | | 12 (25.5) | 25 (37.3) | 7 (41.2) | |
| Other | | 1 (2.1) | 6 (9.0) | 0 (0.0) | |
| 14. Do you have the same type of insurance now? (yes) | 142 | 46 (92.0) | 67 (91.8) | 17 (89.5) | .84 |
| 15. What is your current employment status | 142 | | | | .58 |
| Retired | | 43 (86.0) | 57 (78.1) | 14 (73.7) | |
| Employed | | 7 (14.0) | 15 (20.5) | 5 (26.3) | |
| Student | | 0 (0.0) | 1 (1.4) | 0 (0.0) | |
| Student and employed | | | | | |
| 16. What level of formal education did you reach? | 142 | | | | .78 |
| High school or GED | | 12 (24.0) | 18 (24.7) | 4 (21.1) | |
| College | | 27 (54.0) | 32 (43.8) | 9 (47.4) | |
| Graduate school | | 11 (22.0) | 23 (31.5) | 6 (31.6) | |
| 17. Is your current or past occupation in the health care field? (yes) | 142 | 6 (12.0) | 11 (15.1) | 7 (36.8) | .061 |
| 18. Will you try to obtain more information about your current blood thinner? (yes) | 142 | 17 (34.0) | 37 (50.7) | 9 (47.4) | .28 |
| 19. To the best of your recollection, how long have you been on the current blood thinner? | 142 | | | | NA ^a |
| Less than 1 year | | 9 (18.0) | 23 (31.5) | 10 (52.6) | |
| 1-5 years | | 33 (66.0) | 36 (49.3) | 7 (36.8) | |
| More than 5 years | | 8 (16.0) | 14 (19.2) | 2 (10.5) | |
| 20. Were you ever hospitalized for an episode of serious bleeding that your doctors attributed to the use of the blood thinner? (yes) | 141 | 4 (8.2) | 1 (1.4) | 2 (10.5) | .079 |

P-values result from Spearman's test of correlation (continuous variables), a Cochran-Armitage trend test (categorical variables with 2 groups) or Fisher's exact test (categorical variables with >2 groups).

^aP-values are not provided for questions 1, 2, 3, 4, 6, 7, 10, 12, and 19, as these questions were used to define the low, moderate, and high categories.

NOAC knowledge. Low health literacy among patients with CHF is associated with increased risk of hospitalization and death.²¹ An educational intervention for CHF patients in particular that includes disease process education, treatment education, clarification of doubts, verification of knowledge and addressing knowledge gaps led to improvement in attitudes and behaviors.²²

A previous study conducted at our institution with a similar survey among patients with atrial fibrillation on VKA therapy found that 69.7% of patients were unsure about the stroke risk reduction benefits provided by warfarin, 64.6% were unsure about their bleeding risk while on warfarin, and 13.1% answered not knowing significant drug-food or drug-drug interactions. In the present study, 61.3% of patients on NOAC therapy for atrial fibrillation were unsure about the stroke risk reduction benefits of NOAC therapy, 68.8% were unsure about their risk of bleeding, and 23.2% answered not feeling sure about the significant drug-drug and drug-food interactions. This suggests that although knowledge may be similar regarding benefits, knowledge regarding risks and drug-drug or drug-food interactions may be lower in patients taking NOAC therapy for atrial fibrillation. Warfarin therapy requires frequent monitoring of the INR. At our institution, each visit in the anticoagulation clinic for warfarin INR monitoring includes patient education.⁷ In contrast, patients on NOAC therapy do not require frequent blood testing for monitoring which leads to fewer opportunities to provide NOAC-related education. This may account for the difference in knowledge regarding risks and interactions between these 2 groups.

However, this study also found that patients classified as having a high degree of knowledge regarding NOAC therapy and atrial fibrillation tended to have been on NOAC therapy longer. This suggests that knowledge is improving with time on treatment, although there are no regularly scheduled NOAC educational sessions at our institution. This finding needs further investigation to determine factors associated with the increase in knowledge over time, and if knowledge tends to decline after a certain time period. Although the range of months on NOAC therapy was wide for each group, the difference in the median length of time on NOAC between the low-knowledge and high-knowledge groups was only 2 months.

Low adherence may be particularly risky for patients on NOAC therapy compared with warfarin therapy, given the differences in pharmacokinetics—a single missed dose of a NOAC can result in subtherapeutic anticoagulation.² Based on published adherence rates for patients on NOAC therapy,¹¹ interventions are needed to help improve these. Educational interventions seem effective,⁸ but studies are limited. Further research is needed to evaluate the effect of educational interventions on groups of patients with atrial fibrillation at highest risk of poor outcomes due to low adherence, and low treatment and disease-related knowledge. Further study regarding the level of knowledge in

patients who have transitioned from VKA to NOAC therapy compared with those who have only taken NOAC therapy would be relevant as well.

Several limitations of this study are important to consider. The design is retrospective, being based on chart reviews, which introduces biases inherent to this method of the data collection. This is a single-center study which may limit the generalizability of the results. Survey data was collected during the COVID-19 pandemic which may have systematically affected patients who presented to the office for an appointment (surveys were not done virtually). Additionally, the sample size is relatively small, and therefore the possibility of a type II error (ie, a false-negative finding) is important to consider; we cannot conclude that a true difference does not exist simply due to a non-significant *P*-value in our study.

Conclusions

Knowledge level regarding atrial fibrillation and its treatment correlates with adherence. Studies have demonstrated the positive effects of patient education on adherence to NOAC therapy. When developing educational interventions to help improve NOAC therapy knowledge in patients with atrial fibrillation, it is important to consider advanced age, increased comorbidity burden, and having been on NOAC therapy for a shorter period of time, as factors associated with poorer knowledge regarding NOAC therapy for atrial fibrillation.

Acknowledgments

None

Authors' Contributions

JRV contributed with manuscript preparation, protocol design, and data collection supervision. AM contributed with data collection and survey distribution. GP, CW, PF and EW contributed with study design and survey distribution and manuscript preparation. YA contributed with data collection and survey distribution. DMH contributed with study design, survey distribution, and manuscript preparation. LM contributed with study design, survey distribution, and manuscript preparation. MH and LW contributed with statistical analysis and manuscript preparation. FS contributed with study oversight, study design, data collection and survey distribution supervision, and manuscript preparation.




Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Funds for the statistical analysis of this study were provided by the Division of Community Internal Medicine, Mayo Clinic Florida.

ORCID iDs

Jose Raul Valery  <https://orcid.org/0000-0003-2671-7854>
 Dana M. Harris  <https://orcid.org/0000-0003-0820-9215>
 Fernando Stancampiano  <https://orcid.org/0000-0002-9162-1632>

Supplemental Material

Supplemental material for this article is available online.

References

1. Steffel J, Collins R, Antz M, et al. Corrigendum to: 2021 European Heart Rhythm Association practical guide on the use of non-vitamin K antagonist oral anticoagulants in patients with atrial fibrillation. *Europace*. 2021;23(10):1612-1676.
2. Vitolo M, Lane DA, Boriani G, Lip GYH. The importance of adherence and persistence with oral anticoagulation treatment in patients with atrial fibrillation. *Eur Heart J*. 2021;7(FI1):f81-f83.
3. Oake N, Jennings A, Forster AJ, Fergusson D, Doucette S, van Walraven C. Anticoagulation intensity and outcomes among patients prescribed oral anticoagulant therapy: a systematic review and meta-analysis. *CMAJ*. 2008;179(3):235-244.
4. Khan TI, Kamali F, Kesteven P, Avery P, Wynne H. The value of education and self-monitoring in the management of warfarin therapy in older patients with unstable control of anticoagulation. *Br J Haematol*. 2004;126(4):557-564.
5. Liu C, Du X, Jiang C, et al. Long-term persistence with newly-initiated warfarin or non-VKA oral anticoagulant (NOAC) in patients with non-valvular atrial fibrillation: insights from the prospective China-af Registry. *Med Sci Monit*. 2019;25:2649-2657.
6. Metaxas C, Albert V, Habegger S, Messerli M, Hersberger KE, Arnet I. Patient knowledge about oral anticoagulation therapy assessed during an intermediate medication review in Swiss community pharmacies. *Pharmacy*. 2020;8(2):54.
7. Fitzgerald P, Stancampiano F, Kurklinsky A, et al. Warfarin therapy in atrial fibrillation: assessment of patient knowledge of risks and benefits. *J Community Hosp Intern Med Perspect*. 2020;10(3):179-187.
8. Márquez-Contreras E, Martell-Claros N, Márquez-Rivero S, et al. Strategies for improving dabigatran adherence for stroke prevention in patients with non-valvular atrial fibrillation: education and drug intake reminders (FACILITA study). *Curr Med Res Opin*. 2018;34(7):1301-1308.
9. Lip GY, Nieuwlaat R, Pisters R, Lane DA, Crijns HJ. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the euro heart survey on atrial fibrillation. *Chest*. 2010;137(2):263-272.
10. O'Brien EC, Simon DN, Thomas LE, et al. The ORBIT bleeding score: a simple bedside score to assess bleeding risk in atrial fibrillation. *Eur Heart J*. 2015;36(46):3258-3264.
11. Ozaki AF, Choi AS, Le QT, et al. Real-world adherence and persistence to direct oral anticoagulants in patients with atrial fibrillation: a systematic review and meta-analysis. *Circ Cardiovasc Qual Outcomes*. 2020;13(3):e005969.
12. Paquette M, Witt DM, Holbrook A, et al. A systematic review and meta-analysis of supplemental education in patients treated with oral anticoagulation. *Blood Adv*. 2019;3(10):1638-1646.
13. Noseworthy PA, Brito JP, Kunneman M, et al. Shared decision-making in atrial fibrillation: navigating complex issues in partnership with the patient. *J Interv Card Electrophysiol*. 2019;56(2):159-163.
14. Benedetti G, Neccia M, Agati L. Direct oral anticoagulants use in elderly patients with non valvular atrial fibrillation: state of evidence. *Minerva Cardioangiol*. 2018;66(3):301-313.
15. Chenot JF, Hua TD, Abu Abed M, et al. Safety relevant knowledge of orally anticoagulated patients without self-monitoring: a baseline survey in primary care. *BMC Fam Pract*. 2014;15:104.
16. Gellad WF, Grenard JL, Marcum ZA. A systematic review of barriers to medication adherence in the elderly: looking beyond cost and regimen complexity. *Am J Geriatr Pharmacother*. 2011;9(1):11-23.
17. Weiss BD, Mollon L, Lee JK. Readability of patient education information on the American Geriatrics Society Foundation's Health-in-Aging website. *J Am Geriatr Soc*. 2013;61(10):1845-1846.
18. van Ballegooye C, Hoang P. Assessment of the readability of online patient education material from major geriatric associations. *J Am Geriatr Soc*. 2021;69(4):1051-1056.
19. Drugs.com. Eliquis FDA Approval History. Published 2022. Accessed June 3, 2022. <https://www.drugs.com/history/eliquis.html>
20. Drugs.com. Xarelto FDA Approval History. Published 2022. Accessed June 3, 2022. <https://www.drugs.com/history/xarelto.html>
21. Fabbri M, Yost K, Finney Rutten LJ, et al. Health literacy and outcomes in patients with heart failure: a prospective community study. *Mayo Clin Proc*. 2018;93(1):9-15.
22. Oliveira APD, Cavalcante AMRZ, Carneiro CS, et al. Health education: the effectiveness of interventions in patients with heart failure. *Rev Bras Enferm*. 2020;73(2):e20180782.